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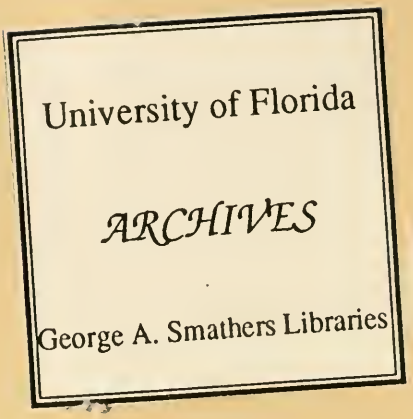

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Graduate School Catalog

UNIVERSITY OF FLORIDA RECORD
GAINESVILLE 1971-1972

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1971

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University of Florida Calendar

1971-1972

FALL QUARTER

1971

July 2, Friday, 4:00 p.m.	Last day for students currently enrolled to file application at the Office of the Registrar for admission to Graduate School.
July 16, Friday, 4:00 p.m.	Last day for those not previously in attendance at the University of Florida to file application for admission for the Fall Quarter, and for those previously in attendance to apply for registration appointments.
September 3, Friday, 4:00 p.m.	Last day for clearing admissions for those whose application was filed by above deadline. All credentials must have been received and college changes approved. Those who clear after this date will be assigned late registration appointments.
September 14-16, Tuesday-Thursday	Registration (including payment of fees) according to appointments assigned. No one permitted to start registration on Thursday, September 16, after 3:00 p.m.
September 15, Wednesday	Last day for receipt at Princeton, N. J., of ETS foreign language examination fee of $10 for reading knowledge examinations in French, German, Russian, and Spanish on October 9. Registration fees increase $3 after this day and up to closing date of September 22.
September 17, Friday	Last day for paying fees without being subject to late fee.
	Drop-and-add period begins.
	Last day for completing registration for Fall Quarter. Registration fees increase $25 for students beginning registration. No one permitted to start registration after 3:00 p.m.
September 20, Monday	Classes begin.
September 22, Wednesday, 4:00 p.m.	Last day for adding courses and for changing sections.
September 29, Wednesday, 4:00 p.m.	Last day for dropping courses without receiving a grade of E.

October 1, Friday ..... Last day for filing an application for Admission to Candidacy for a master's degree to be conferred at the end of this term.

October 5, Tuesday ..... Last day for receipt by the Educational Testing Service, Princeton, N.J. 08540, of Registration Form for the October 23 Graduate Record Examination. Registration fees increase $3 after this day and up to the closing date of October 8.

October 9, Saturday, 8:45 a.m. ..... ETS foreign language reading knowledge examinations in French, German, Russian, and Spanish, Leigh 207.

October 15, Friday, 4:00 p.m. ..... Last day for filing degree application at the Registrar's Office for a degree to be conferred at the end of the Fall Quarter.

Last day for removing grades of I or X received in the preceding term of attendance.

Last day for students currently enrolled to file application at the Office of the Registrar for admission to the Graduate School.

October 22-23, Friday-Saturday ..... Homecoming. Classes suspended.

October 23, Saturday, 8:45 a.m. ..... Graduate Record Examination administered in Carleton Auditorium.

October 25, Monday ..... Midpoint of term for completing doctoral qualifying examination.

November 8, Monday ..... Last day for candidates for doctoral degrees to file dissertations with the Graduate School, and for master's candidates to file abstracts.

Library binding fee and microfilm fee due.

November 16, Tuesday ..... Last day for receipt by the Educational Testing Service, Princeton, N.J. 08540, of Registration Form for the December 11 Graduate Record Examination. Registration fees increase $3 after this day and up to the closing date of November 23.

November 19, Friday, 4:00 p.m. ..... Last day for withdrawing without receiving failing grades in all courses.

November 25-27, Thursday-Saturday .... Thanksgiving. Classes suspended.

November 29, Monday, 8:00 a.m. ..... Classes resume.

November 29, Monday ..... Last day for college offices to submit to the Graduate School the original, signed copy of thesis or dissertation and the final examination Report.

December 3, Friday ..... All classes end.

December 6, Monday ..... Final examinations begin.

December 9, Thursday, noon ..... Grades for degree candidates due in the Office of the Registrar.

December 10, Friday, noon ..... Report of colleges on candidates for degrees due in the Graduate School Office.

December 11, Saturday ..... Commencement Convocation.

December 11, Saturday, 8:45 a.m. ..... Graduate Record Examination administered in Carleton Auditorium.

December 13, Monday, 10:00 a.m. ..... All grades for Fall Quarter due in the Office of the Registrar.

WINTER QUARTER

1971

November 19, Friday, 4:00 p.m. ..... Last day for those not previously in attendance at the University of Florida to file application for admission for the Winter Quarter, and for those previously in attendance to apply for registration appointments.

December 10, Friday, 4:00 p.m. ..... Last day for clearing admissions for those whose application was filed by above deadline. All credentials must have been received and college changes approved. Those who clear after this date will be assigned late registration appointments.

December 21, Tuesday ..... Last day for receipt by the Educational Testing Service, Princeton, N.J. 08540, of Registration Form for the January 15 Graduate Record Examination. Registration fees increase $3 after this day and up to the closing date of December 28.

1972

January 3, Monday ..... Registration according to appointments assigned (including payment of fees). No one permitted to start registration after 3:00 p.m. Last day for paying fees without being subject to late fee.

January 4, Tuesday ..... Classes begin. Last day for completing registration for Winter Quarter. All registration fees increase $25. No one permitted to start registration after 3:00 p.m.

January 7, Friday, 4:00 p.m. ..... Last day for adding courses and for changing sections.

January 12, Wednesday ..... Last day for receipt at Princeton, N. J., of ETS foreign language examination fee of $10 for reading knowledge examinations in French, German, Russian, and Spanish on February 5. Registration fees increase $3 after this day and up to closing date of January 19.

January 13, Thursday, 4:00 p.m. ..... Last day for dropping courses without receiving a grade of E.

January 14, Friday ..... Last day for filing an application for Admission to Candidacy for a master's degree to be conferred at the end of this term.

January 15, Saturday, 8:45 a.m. ..... Graduate Record Examination administered in Carleton Auditorium.

January 21, Friday, 4:00 p.m. ..... Last day for removing grades of I or X received in the preceding term of attendance.

Last day for students currently enrolled to file application at the Office of the Registrar for admission to Graduate School.

January 28, Friday, 4:00 p.m. ..... Last day for filing degree application at the Registrar's Office for a degree to be conferred at the end of the Winter Quarter.

February 1, Tuesday ..... Last day for receipt by the Educational Testing Service, Princeton, N.J. 08540, of Registration Form for the February 26 Graduate Record Examination. Registration fees increase $3 after this day and up to the closing date of February 8.

February 5, Saturday, 8:45 a.m. ..... ETS foreign language reading knowledge examinations in French, German, Russian, and Spanish, Leigh 207.

February 8, Tuesday ..... Midpoint of term for completing doctoral qualifying examination.

February 14, Monday ..... Last day for candidates for doctoral degrees to file dissertations with the Graduate School, and for master's candidates to file abstracts.

Library binding fee and microfilm fee due.

February 25, Friday, 4:00 p.m. ..... Last day for withdrawing without receiving failing grades in all courses.

February 26, Saturday, 8:45 a.m. ..... Graduate Record Examination administered in Carleton Auditorium.

March 6, Monday ..... Last day for college offices to submit to the Graduate School the original, signed copy of thesis or dissertation and the final examination Report.

March 10, Friday ..... All classes end.

March 13, Monday ..... Final examinations begin.

March 16, Thursday, noon ..... Grades for degree candidates due in the Office of the Registrar.

March 17, Friday, noon ..... Report of colleges on candidates for degrees due in the Graduate School Office.

March 18, Saturday ..... Commencement Convocation.

March 20, Monday, 10:00 a.m. ..... All grades for Winter Quarter due in the Office of the Registrar.

SPRING QUARTER

1972

February 18, Friday, 4:00 p.m. ..... Last day for those not previously in attendance at the University of Florida to file application for admission for the Spring Quarter, and for those previously in attendance to apply for registration appointments.

March 3, Friday, 4:00 p.m. ..... Last day for clearing admissions for those whose application was filed by above deadline. All credentials must have been received and college changes approved. Those who clear after this date will be assigned late registration appointments.

March 22, Wednesday ..... Last day for receipt at Princeton, N. J., of ETS foreign language examination fee of $10 for reading knowledge examinations in French, German, Russian, and Spanish on April 15. Registration fees increase $3 after this day and up to closing date of March 29.

March 24, Friday ..... Registration according to appointments assigned (including payment of fees). No one permitted to start registration after 3:00 p.m. Last day for paying fees without being subject to late fee.

March 27, Monday ..... Classes begin. Last day for completing registration for Spring Quarter. All registration fees increase $25. No one permitted to start registration after 3:00 p.m.

March 28, Tuesday ..... Last day for receipt by the Educational Testing Service, Princeton, N.J. 08540, of Registration Form for the April 22 Graduate Record Examination. Registration fees increase $3 after this day and up to the closing date of April 4.

March 29, Wednesday, 4:00 p.m. ..... Last day for adding courses and for changing sections.

April 5, Wednesday, 4:00 p.m. ..... Last day for dropping courses without receiving a grade of E.

April 7, Friday ..... Last day for filing an application for Admission to Candidacy for a master's degree to be conferred at the end of this term.

April 14, Friday, 4:00 p.m. ..... Last day for removing grades of I or X received in preceding term of attendance.

Last day for students currently enrolled to file application at the Office of the Registrar for admission to Graduate School.

April 15, Saturday, 8:45 a.m. ..... ETS foreign language reading knowledge examinations in French, German, Russian, and Spanish, Leigh 207.

April 21, Friday, 4:00 p.m. ..... Last day for filing degree application at the Registrar's Office for a degree to be conferred at the end of the Spring Quarter.

April 22, Saturday, 8:45 a.m. ..... Graduate Record Examination administered in Carleton Auditorium.

May 1, Monday ..... Midpoint of term for completing doctoral qualifying examination.

May 8, Monday ..... Last day for candidates for doctoral degrees to file dissertations with the Graduate School, and for master's candidates to file abstracts.

Library binding fee and microfilm fee due.

May 19, Friday, 4:00 p.m. ..... Last day for withdrawing without receiving failing grades in all courses.

May 23, Tuesday ..... Last day for receipt by the Educational Testing Service, Princeton, N.J. 08540, of Registration Form for the June 17 Graduate Record Examination. Registration fees increase $3 after this day and up to the closing date of May 30.

May 29, Monday ..... Last day for college offices to submit to the Graduate School the original, signed copy of thesis or dissertation and the final examination Report.

June 2, Friday ..... All classes end.

June 5, Monday ..... Final examinations begin.

June 8, Thursday, noon ..... Grades for degree candidates due in the Office of the Registrar.

June 9, Friday, noon ..... Report of colleges on candidates for degrees due in the Graduate School Office.

June 10, Saturday ..... Commencement Convocation.

June 12, Monday, 10:00 a.m. ..... All grades for Spring Quarter due in the Office of the Registrar.

SUMMER QUARTER

1972

April 28, Friday, 4:00 p.m. ..... Last day for those not previously in attendance at the University of Florida to file application for admission for the Summer Quarter, and for those previously in attendance to apply for registration appointments.

May 19, Friday, 4:00 p.m.	Last day for clearing admissions for those whose application was filed by above deadline. All credentials must have been received and college changes approved. Those who clear after this date will be assigned late registration appointments.
June 16, Friday	Registration according to appointments assigned (including payment of fees). No one permitted to start registration after 3:00 p.m. Last day for paying fees without being subject to late fee.
June 17, Saturday, 8:45 a.m.	Graduate Record Examination administered in Carleton Auditorium.
June 19, Monday	Classes begin. Last day for completing registration for Summer Quarter. All registration fees increase $25. No one permitted to start registration after 3:00 p.m.
June 21, Wednesday, 4:00 p.m.	Last day for adding courses and for changing sections.
June 28, Wednesday, 4:00 p.m.	Last day for dropping courses without receiving a grade of E.
June 28, Wednesday	Last day for receipt at Princeton, N. J., of ETS foreign language examination fee of $10 for reading knowledge examinations in French, German, Russian, and Spanish on July 22. Registration fees increase $3 after this day and up to closing date of July 5.
June 30, Friday	Last day for filing an application for Admission to Candidacy for a master's degree to be conferred at the end of this term.
July 7, Friday, 4:00 p.m.	Last day for removing grades of I or X received in preceding term of attendance.
	Last day for students currently enrolled to file application at the Office of the Registrar for admission to Graduate School.
July 14, Friday, 4:00 p.m.	Last day for filing degree application at the Registrar's Office for a degree to be conferred at the end of the Summer Quarter.
July 22, Saturday, 8:45 a.m.	ETS foreign language reading knowledge examinations in French, German, Russian, and Spanish, Leigh 207.
July 24, Monday	Midpoint of term for completing doctoral qualifying examination.
	Last day for candidates for doctoral degrees to file dissertations with the Graduate School, and for master's candidates to file abstracts.
	Library binding fee and microfilm fee due.

August 4, Friday, 4:00 p.m.	Last day for withdrawing without receiving failing grades in all courses.
August 14, Monday	Last day for college offices to submit to the Graduate School the original, signed copy of thesis or dissertation and the final examination Report.
August 18, Friday	All classes end.
August 21, Monday	Final examinations begin.
August 24, Thursday, noon	Grades for degree candidates due in the Office of the Registrar.
August 25, Friday, noon	Report of colleges on candidates for degrees due in the Graduate School Office.
August 26, Saturday	Commencement Convocation.
August 28, Monday, 10:00 a.m.	All grades for Summer Quarter due in the Office of the Registrar.

General Information

THE GRADUATE SCHOOL

Organization and History

The Graduate School consists of the dean, the assistant deans, the Graduate Council, and the graduate faculty. General policies and standards of the Graduate School are established by the graduate faculty. The Graduate School is responsible for the enforcement of minimum general standards of graduate work in the University and for the coordination of the graduate programs of the various colleges and divisions of the University. The responsibility for the detailed operations of graduate programs is vested in the individual colleges, divisions, and departments. In most of the colleges an assistant dean or other official is directly responsible for graduate study in his college.

The Graduate Council, of which the dean is chairman, assists him in being the agent of the graduate faculty for execution of policy related to graduate study and associated research. The Council considers petitions and recommends the award of graduate degrees. Members of the graduate faculty, who are appointed by the dean with the approval of the Graduate Council, fall into two categories in accordance with their function: the Graduate Studies Faculty, who are appointed to teach graduate courses and to direct master's theses, and the Doctoral Research Faculty, who are appointed in addition to direct doctoral dissertations. No staff member is expected to perform any of these functions without having been appointed to the graduate faculty, though temporary exceptions may be made in unusual circumstances.

In the beginning the organization of graduate study was very informal. Control was in the hands of a faculty committee which reported directly to the President. In 1910, however, James N. Anderson, head of the Department of Ancient Languages, was appointed Dean of the College of Arts and Sciences and Director of Graduate Work, and in 1930 he became the first dean of the Graduate School. He was succeeded upon his retirement in 1938 by T. M. Simpson, head of the Department of Mathematics, who held the position until he became dean emeritus in 1951. C. F. Byers, head of the Department of Biological Sciences in the University College, served as acting dean from June 1951 until August 1952, when he was succeeded by L. E. Grinter, who came from the Illinois Institute of Technology, where he had been Vice President, Dean of the Graduate School, and Research Professor. Upon becoming Acting Executive Vice President in 1969, he was succeeded by the present dean, Harold P. Hanson, who came to Florida from the University of Texas, where he had served as Chairman of the Department of Physics.

Study leading to graduate degrees has existed at the University of Florida from the date of the establishment of the University on its present campus. The

first M.A. was awarded in 1906, the major being English, and the first M.S. in 1908, with a major in entomology. The first programs leading to the Ph.D. were initiated in 1930, and the first degrees were awarded in 1934, one with a major in chemistry and the other with a major in pharmacy. The first Ed.D. was awarded in 1948. Graduate study has had a phenomenal growth at the University of Florida. In 1920 two degrees were awarded in two fields. In 1930, 33 degrees were awarded in 12 fields. In 1940, 66 degrees were awarded in 16 fields. In 1969-1970 the total number of degrees awarded was 1223 in more than 90 fields. The proportion of doctor's degrees has increased steadily. In 1950, 18 Ph.D.'s and 5 Ed.D.'s were awarded. In 1969-1970 the totals were 230 Ph.D.'s and 64 Ed.D.'s.

GRADUATE PROGRAMS

The Graduate School offers programs leading to the following degrees:

MASTER OF AGRICULTURE (M.Ag.), with major in any field in agriculture

MASTER OF ARTS (M.A.), with major in one of the following:

- Accounting
- Anthropology
- Economics
- English
- Finance and Insurance
- French
- Geography
- German
- History
- Latin
- Latin American Area Studies
- Linguistics
- Management and Business Law
- Marketing
- Mathematics
- Philosophy
- Political Science
- Psychology
- Real Estate
- Sociology
- Spanish
- Speech

MASTER OF ARTS IN ARCHITECTURE (M.A.Arch.)

MASTER OF ARTS IN EDUCATION (M.A.E.), with major in one of the following:

- Agricultural Education
- Business Education
- Counselor Education
- Educational Administration
- Elementary Education
- Foundations of Education
- Music Education
- Secondary Education
- Special Education

MASTER OF ARTS IN HEALTH EDUCATION (M.A.H.Ed.)

MASTER OF ARTS IN JOURNALISM AND COMMUNICATIONS (M.A.J.C.)

MASTER OF ARTS IN PHYSICAL EDUCATION (M.A.P.E.)

MASTER OF ARTS IN TEACHING (M.A.T.), with major in appropriate departments in the various colleges

MASTER OF BUILDING CONSTRUCTION (M.B.C.)

MASTER OF BUSINESS ADMINISTRATION (M.B.A.), with major in any field in business administration and in health and hospital administration

MASTER OF EDUCATION (M.Ed.), with major in any field in education, including business education and music education

MASTER OF ENGINEERING (M.E.)

MASTER OF FINE ARTS (M.F.A.)

MASTER OF HEALTH EDUCATION (M.H.Ed.)

MASTER OF NURSING (M.Nsg.)

MASTER OF PHYSICAL EDUCATION (M.P.E.)

MASTER OF REHABILITATION COUNSELING (M.R.C.)

MASTER OF SCIENCE (M.S.), with major in one of the following:

- Astronomy
- Biochemistry
- Botany
- Chemistry
- Entomology and Nematology
- Geography
- Geology
- Mathematics
- Microbiology
- Pathology
- Physics
- Plant Pathology
- Psychology
- Radiation Biophysics
- Veterinary Science
- Zoology

MASTER OF SCIENCE IN AGRICULTURE (M.S.A.), with major in one of the following:

- Agricultural Economics
- Agricultural Education
- Agronomy
- Animal Science
- Dairy Science
- Entomology and Nematology
- Food Science
- Fruit Crops
- Ornamental Horticulture
- Plant Pathology
- Poultry Science
- Soils
- Vegetable Crops

MASTER OF SCIENCE IN BUILDING CONSTRUCTION (M.S.B.C.)

MASTER OF SCIENCE IN ENGINEERING (M.S.E.), with major in one of the following:

- Aerospace Engineering
- Agricultural Engineering
- Chemical Engineering
- Civil Engineering
- Coastal and Oceanographic Engineering
- Electrical Engineering
- Engineering Mechanics
- Engineering Science
- Environmental Engineering Sciences
- Industrial and Systems Engineering
- Mechanical Engineering
- Metallurgical and Materials Engineering
- Nuclear Engineering Sciences

MASTER OF SCIENCE IN FORESTRY (M.S.F.)

MASTER OF SCIENCE IN PHARMACY (M.S.P.), with major in one of the following:

- Pharmaceutical Chemistry
- Pharmacognosy
- Pharmacy

MASTER OF SCIENCE IN STATISTICS (M.S.Stat.)

MASTER OF SCIENCE IN TEACHING (M.S.T.), with major in appropriate departments in the various colleges

MASTER OF STATISTICS (M.Stat.)

ENGINEER (Engr.)—a special degree requiring one year of graduate work beyond the master's degree

SPECIALIST IN EDUCATION (Ed.S.)—a special degree requiring one year of graduate work beyond the master's degree

DOCTOR OF EDUCATION (Ed.D.), with major in one of the following:

- Counselor Education
- Curriculum and Instruction
- Educational Administration
- Foundations of Education
- Special Education

DOCTOR OF PHILOSOPHY (Ph.D.), with major in one of the following:

- Aerospace Engineering
- Agricultural Economics
- Agronomy
- Animal Science
- Anthropology
- Astronomy
- Biochemistry
- Botany
- Business Administration
- Chemical Engineering
- Chemistry
- Civil Engineering
- Economics
- Education, including
  - Counselor Education
  - Curriculum and Instruction
  - Educational Administration
  - Foundations of Education
  - Special Education
- Electrical Engineering
- Engineering Mechanics
- English
- Entomology and Nematology
- Environmental Engineering Sciences
- French
- Fruit Crops
- Geography
- History
- Linguistics
- Mathematics
- Mechanical Engineering
- Medical Sciences, including
  - Immunology and Medical Microbiology
  - Neuroscience
  - Pathology
  - Pharmacology
  - Physiology
- Metallurgical and Materials Engineering
- Microbiology
- Nuclear Engineering Sciences
- Pharmaceutical Chemistry
- Pharmacognosy
- Pharmacy
- Physics
- Plant Pathology
- Political Science, including International Relations
- Psychology
- Sociology
- Soils
- Spanish
- Speech
- Statistics
- Systems Engineering (Operations Research)
- Vegetable Crops
- Zoology

ADMISSION TO THE GRADUATE SCHOOL

APPLICATION FOR ADMISSION to the Graduate School must be made to the Director of Admissions on forms supplied by his office and at times stipulated in the *University Calendar*. Applications which meet minimum standards for admissions are referred by the Director to the graduate selection committees of the various colleges and divisions for approval or disapproval.

No application will be considered unless the complete official transcripts of all the applicant's undergraduate and graduate work are in the possession of the Registrar, and no transcript will be accepted as official unless it is received directly from the Registrar of the institution in which the work was done. Official supplementary transcripts are required, as soon as they are available, for any work completed after the application for admission has been made. In general, no student who is a graduate of a nonaccredited institution will be considered for graduate study in any unit of the University.

The University encourages applications from qualified persons of all cultural, racial, religious, and ethnic groups.

UNDERGRADUATE RECORD

Unqualified admission to the Graduate School is commonly dependent upon the presentation of a baccalaureate degree from an accredited college or curriculum, with an average grade of B for the junior and senior years. In some units of the Graduate School and on the more advanced levels of graduate study, an undergraduate average considerably above B may be required. In some units (see the following three paragraphs) admission may be considered with an undergraduate average somewhat below B. College graduate admission selection committees consider not only the general grade average, but the distribution of work and the quality and extent of preparation for the graduate program the student proposes to undertake.

In the College of Education, admission to programs leading to the degrees of Master of Arts in Education or Master of Education is normally limited to those students who have maintained at least a 2.75 grade-point average in their last two years.

The minimum undergraduate grade average acceptable for admission to programs leading to the master's degrees in Physical Education and Health Education is 2.5 in the last two years.

In the College of Agriculture, admission to graduate study is normally limited to those students who have maintained at least a 2.75 grade-point average in their last two years and 3.0 in their major subject. For students with an undergraduate major in general agriculture, the minimum upper-division average is 2.85. In exceptional cases, where a candidate has demonstrated in some other way his fitness to do graduate work, as, for instance, outstanding achievement since earning the bachelor's degree, he may be considered for admission.

While the general admissions requirements described above apply to both

master's and doctoral candidates, it should be noted that doctoral candidates must meet certain additional requirements which vary according to the programs established by the departments and colleges. Furthermore, it is desirable for students planning to enter certain colleges and departments to have a reading knowledge of at least one foreign language.

Graduate Record Examination

A satisfactory average score on the Graduate Record Examination is required for admission. Each applicant for admission must submit scores on the aptitude test of the GRE, but, either at the request of the department concerned or on his own volition, the applicant is encouraged to submit in addition the score on one or more advanced subject matter tests of the GRE. The scores on all tests taken will be weighed in regard to admission.

The GRE is given six times a year—October, December, January, February, April, and June—at a great many locations in the United States, including Gainesville, Florida. To determine exact dates and the most convenient locations, students should write to the Educational Testing Service, Princeton, New Jersey 08540. Applications are required several weeks prior to the examination, and scores are received about a month after the examination. Hence, it is necessary to apply for the GRE in early September for admission in January, in early December for admission in March, in early January for admission in June, and in early March for admission in September. Other examinations are given for which application must be made in November and May, but the ones listed above are correlated with admissions deadlines.

Postponement of the GRE.—If a student applies for admission too late to take the GRE before his expected date of entry, particularly for a summer session, he may apply for admission to the Graduate School with postponement of the GRE and submit his score on the Miller Analogies Test to be used as a partial basis for deciding whether tentative admission may be granted. It should be noted, however, that the Miller Analogies Test is not a substitute for the GRE. In cases where the GRE has been postponed it must be taken with satisfactory results before a second registration will be permitted.

The Miller Analogies Test is given at about 250 colleges and universities throughout the country, and is administered by the University Counseling Center, Room 311, Little Hall, throughout the calendar year at 2:45 p.m. on Wednesday and Thursday. Special appointments can be made by contacting the Counseling Center. The cost of the test, $3, should be paid to Student Accounts, the Hub, and the receipt should be presented at the time of testing.

Test scores should be presented to the Dean of the Graduate School. No student can be considered for postponement of the GRE until after his application for admission is otherwise complete and all his credentials have been received in the Office of the Registrar.

Admission Test for Graduate Study in Business.—Students applying

for admission to the Graduate School who wish to pursue degrees in the College of Business Administration may submit satisfactory scores on the Admission Test for Graduate Study in Business (ATGSB) as a substitute for the required scores on the Aptitude portion of the Graduate Record Examination.

The ATGSB is given five times a year—November, February, April, June, and August—at many locations in the United States, including Gainesville, Florida. To determine exact dates and the most convenient locations, students should write to the Educational Testing Service, Princeton, New Jersey 08540.

Admission to the Graduate Engineering Education System (GENESYS)

All applicants seeking to enroll for credit in courses through GENESYS must secure admission to the University of Florida. Application for admission must be made to the Admissions Section, Office of the Registrar, University of Florida, on forms obtained from the Resident Director of GENESYS at Cape Kennedy, Orlando, Daytona Beach, or West Palm Beach. No application will be considered unless complete official transcripts of all the applicant's undergraduate and graduate work are in the possession of the Registrar and no transcript will be accepted as official unless it is received directly from the Registrar of the institution in which the work was done.

Applicants for GENESYS may be admitted initially to the Graduate School, or to the College of Engineering, as postgraduate students, depending upon the applicant's qualifications and objectives. In order to be admitted to the Graduate School, the GENESYS applicant must satisfy all admission requirements established by the Graduate School. Briefly stated these requirements include the presentation of a baccalaureate degree in engineering or science from an accredited college or curriculum with an average grade of B for the junior and senior years; a satisfactory score on the Graduate Record Examinations; and the recommendation of the Graduate Selection Committee of the College of Engineering.

Applicants for GENESYS who do not fully meet the requirements for admission to the Graduate School or who do not desire to work for a graduate degree may be admitted to the College of Engineering as *postgraduate students*. Such students may subsequently be admitted to the Graduate School by removing any deficiencies in their qualifications. Applications will be considered individually on the basis of the applicant's overall record. The basic requirement for admission to GENESYS as a postgraduate student in the College of Engineering is the possession of the baccalaureate degree in engineering or science from an accredited college or curriculum. Although test scores from the Graduate Record Examination are not required, applicants are strongly advised to submit GRE scores on the aptitude and advanced engineering test as evidence of their qualification for admission. Satisfactory scores on the GRE will be required for subsequent admission to the Graduate School.

Admission Procedures for Foreign Students

All foreign students whose native tongue is not English making application for admission to the Graduate School of the University of Florida must present their scores on TOEFL (Testing of English as a Foreign Language). Each applicant is asked to write TOEFL, Educational Testing Service, Princeton, New Jersey 08540, U.S.A., requesting a Bulletin of Information and registration form. A final consideration cannot be granted a foreign student's application for admission until his scores on this test are received by: Admissions Section, Office of the Registrar, University of Florida, Gainesville, Florida 32601, U. S. A.

All students are required to submit satisfactory scores on the Graduate Record Examination for admission to the Graduate School. However, students educated in foreign countries who apply for admission while residing outside the United States may be given a postponement of this requirement until the first quarter of attendance at the University of Florida. Permission to register for a second quarter will depend upon completion of the examination.

Conditional Admission

Students may be given conditional admission to the Graduate School for any of the following reasons: (1) to validate undergraduate records from nonaccredited and unevaluated colleges, (2) to establish the student's ability to meet the requirements of the Graduate School in cases where the quantity or quality of his preparation cannot be determined with sufficient certainty for unconditional admission, (3) to repair deficiencies in an undergraduate program which does not meet the prerequisites for graduate study set by the student's major department, and (4) to ascertain the student's ability to pursue graduate work successfully in cases where his previous grade record or GRE scores are on the borderline of acceptability.

A student who is conditionally admitted to the Graduate School should be notified by his major department of the conditions under which he has been admitted. When those conditions have been satisfied, the department should notify the student in writing and send a copy of the notification to the Graduate School. Work taken while a student is in conditional status may be applied toward a graduate degree.

Postbaccalaureate students (classified 6) who have not been admitted to the Graduate School may take graduate courses, but the work so taken will not normally be transferred to the student's graduate record if he is subsequently admitted to the Graduate School. By petition in clearly justified cases, it is possible to transfer up to nine quarter hours, but in no case will more than nine hours be transferred.

Admission to a Second Graduate Program

A student who has completed a degree program in the Graduate School may not undertake an additional degree program without the approval of the

chairman of the department in which he proposes to do his major work. GRE scores must be submitted by the student at the time he proposes an additional degree program, even though they were not required at the time he started his previous degree work. It is particularly important that the qualifications of the student be carefully weighed before he is permitted to undertake work for the doctor's degree.

Undergraduate Registration in Graduate Courses

With the permission of the instructor and of the college concerned, an undergraduate student at the University of Florida may enroll in 600-level courses if he has senior standing and an upper-division grade-point average of at least 2.8. His registration, during any term in which he is enrolled in a graduate course, may not exceed 17 credits. A 600-level course taken under this provision may be applied toward a graduate degree at the University of Florida after the student has been accepted in the Graduate School if credit for the course has not been used for an undergraduate degree.

Undergraduate students enrolled in the three-year master's degree program may register in graduate courses after obtaining the approval of the program advisory committee and the Assistant Dean of the Graduate School in charge of the program.

Admission of Faculty Members as Graduate Students

Members of the faculty of the University of Florida with a rank of assistant professor or above (or equivalents), except county agents in the Agricultural Extension Service, may not receive a graduate degree from this institution. They may, however, register for work in the Graduate School and apply the credit earned to graduate degrees to be conferred by other institutions.

GENERAL REGULATIONS AND INSTRUCTIONS

Student Responsibility

It is the responsibility of the student to inform himself concerning, and to observe, all regulations and procedures required by the program he is pursuing. *In no case will a regulation be waived or an exception granted because a student pleads ignorance* of the regulation or asserts that he was not informed of it by his adviser or other authority. The student should make himself especially familiar with (1) this section of the *Catalog*, (2) the section presenting the requirements for the degree he plans to take, and (3) the offerings and requirements of his major department.

Consultation with College and Department.—After the student has been admitted to the Graduate School, but before his first registration, he should consult the college and department in which he will do his work concerning course requirements, deficiencies if any, the planning of a program, and special regulations. Departments may have degree requirements that are

not listed in this *Catalog*. All registrations require the signature of the dean of the college (or his representative) in which the degree is to be awarded.

Study Loads

The University of Florida operates on a quarter system consisting of four 10-week periods of instruction and examination. A credit under the quarter system is equal to 2/3 of a semester credit.

Maximum Registration.—The maximum registration in graduate courses and thesis research in any quarter is 17 credits. In addition, all students engaged in supervised research or teaching, except full-time employees, may register in the courses numbered 697 and 698 for an appropriate number of credits from 1 to 5. Part-time employment of any kind, either on or off campus, reduces the maximum study load as indicated by the following table:

Fraction of Time Employed	Maximum Hours a Week Employed	Maximum Course and Thesis Credits	Maximum 697-698 Credit	Total Maximum Credit
none	none	17	5	22
¼ time	12	15	5	20
⅓ time	15	14	5	19
½ time	20	11	5	16
¾ time	30	8	5	13
full time	40	6*	0	6

*Including registration in *one course only* plus thesis research.

Minimum Registration.—Graduate students who receive a stipend of any kind from the University must register for at least the following number of course and thesis credits (exclusive of 697 or 698): Fellows and trainees, 15 credits; one-fourth-time assistants, 12 credits; one-third-time assistants, 9 credits; one-half-time assistants, 8 credits; three-fourth-time assistants, 7 credits. In addition, they should register for an appropriate number of 697 or 698 credits. All other graduate students must register for a minimum of 3 credits.

Courses and Credits

Courses numbered 500-599 are primarily for advanced undergraduate students. They may be used for graduate major credit only if they have been approved for this purpose by the Graduate Council and are listed under the appropriate department in this *Catalog*. Courses numbered 600 and above are limited to graduate students, with the exception described above as *Undergraduate Registration in Graduate Courses*. Courses numbered 700 and above are graduate courses primarily for advanced graduate students.

Undergraduate courses numbered 300 and above are acceptable for minor credit when taken as a part of an approved graduate program. In any case, at least 50 per cent of the minimum course work for any master's degree must be in courses numbered 600 or above.

Registration in the courses numbered 699, Master's Research, and 799, Doctoral Research, may be from 1 to 17 credits in one quarter. Advisers should assign to registration in these courses the number of credits appropriate to the planned work in research. On the assignment of credit for research which is a part of a student's employment, as well as a contribution to his thesis or dissertation, see the section on *Residence* for the Ph.D. degree.

A complete list of approved graduate courses appears in the section of this *Catalog* entitled *Departmental Courses*. Departments reserve the right to decide which of these graduate courses shall be given in any quarter. The published *Schedule of Courses* does not always include all graduate courses offered; the departments, therefore, should be consulted concerning available courses.

CORRESPONDENCE AND EXTENSION WORK.—No courses may be taken for graduate credit by correspondence. No extension courses may be used for graduate credit except in programs for the M.Ag., M.Ed., M.A.E., M.H.Ed., M.P.E., and Ed.S. For regulations governing the use of such courses in the degree programs named, see below, under requirements for specific degrees, the limits on off-campus work. Extension work taken at another institution (except through the Board of Regents Office for Continuing Education) may not be transferred to the University of Florida for graduate credit.

STATE CENTERS FOR CONTINUING EDUCATION.—Course work is available in the graduate residence centers established in the state. Degree programs to which residence center work may be applied are Master of Agriculture, Master of Education, Master of Engineering, Master of Business Administration, Master of Physical Education, and Master of Health Education. The amount of credit acceptable for transfer to a degree program varies according to the degree sought. For regulations governing the use of residence center work in the degree programs named, see below, under requirements for specific degrees.

GRADES

Passing grades for graduate students are A, B, C, and S. Grades of C in courses below 600 level are acceptable for credit toward graduate degrees only if the total program meets the B-average requirement. C grades in 600- and 700-level courses count toward a graduate degree only if a B average has been maintained in all 600-700 level work attempted in a program.

Admission to candidacy for a graduate degree and the award of such a degree depend (among other requirements) upon maintenance of an average grade of B for all work attempted. Any grade of I (incomplete) must be removed by completing all required work, unless a grade-point average of 3.0 is maintained, including incomplete courses. Grades of S and U are not considered in calculating these averages.

Grades of S and U are the only grades that can be awarded to students registered in courses numbered 697 (Supervised Research), 698 (Supervised Teaching); 699 (Master's Research), 799 (Doctoral Research); in FH 602, FH 603, GN 602, GN 603; and in AGE 601, AL 660, ASE 690, CHE 601,

COM 660, EDA 606, EDA 730, EE 695, ENE 670, ESM 690, FY 611, ISE 690, ME 695, MED 628, MSC 600, MTL 670, PS 696, PT 650, STA 691, VC 603.

Unsatisfactory Scholarship

Any graduate student may be denied further registration in the University or in his graduate major if his progress toward the completion of his planned program becomes unsatisfactory. Unsatisfactory progress has been defined by the Graduate Council to include failure to maintain an accumulative grade average of B in *all work attempted* in the Graduate School at the University of Florida.

Change of Major

Graduate students already admitted for work in one department who wish to transfer to another department within the same college, or students who wish to change from one college to another, must make formal application through the Office of the Registrar.

Foreign Language Examinations

In those degree programs where a foreign language examination is required, the following principles and procedures apply:

Those students wishing to be certified as proficient in a reading knowledge of French, German, Russian, or Spanish will take the Graduate School Foreign Language Tests administered by the Educational Testing Service (ETS) and given four times a year on the University of Florida campus. Since the ETS examinations are nationally administered, the Graduate School will accept scores from the examinations taken at any other authorized location in the United States. Candidates submit their applications and fees directly to ETS, Princeton, New Jersey, by the dates listed in the *University Calendar.* The fee for each administration of an examination is $10.

Each of the ETS examinations requires 80 minutes and consists of two separately timed parts. Designed to gauge mastery of the basic vocabulary and structure of the languages, Section I contains 40 multiple-choice questions cast in the foreign language of the test and requires 40 minutes of working time. Section II of the test consists of four alternate parts, each a sample of the literature of one of the following broad fields: biological sciences, humanities, physical sciences, or social sciences. The student selects one of the four fields and answers the questions in English to reveal his understanding of the passage. No dictionaries are allowed. Foreign language examinations other than those covered by the ETS will be given by special arrangement with the foreign language departments. Information may be obtained at the office of the Graduate School.

Procedure for Final Quarter

It is essential that the student inform himself concerning deadline dates as set forth in the *University Calendar* and in the announcements issued by

the Dean of the Graduate School and by the officials of the student's college, school, or department. Regular issues of *Deadline Dates* are available each quarter.

When a student registers for his last term, he must pay the appropriate binding and microfilming fees by the deadline specified in the *University Calendar.*

When his thesis is ready to be put in final form he should get instructions from the office of the Dean of the Graduate School.

A student must be registered in the University for the term in which his final examination is given and at the time he receives a degree.

Awarding of Degrees

The Graduate Council will authorize a candidate to be granted the degree appropriate to his course of study under the following conditions, the details of which can be found under the descriptions of the several degrees:

1. The candidate must have met the residence requirement appropriate to his degree.
2. The candidate must have completed all course requirements, including an internship or practicum if required, in the major and minor fields, observing the relevant limitations on transfer of credit, on nonresident work, and on the level of course work.
3. He must have a grade average of B or above in all work attempted in his graduate program.
4. He must have satisfactorily completed all required examinations: qualifying, comprehensive, and final.
5. All time limits must be observed, such as those affecting the date of the qualifying examination, admission to candidacy, recency of credit, application for a degree, and payment of fees.
6. If it is required, a thesis, dissertation, or equivalent project must have been approved by the supervisory committee and accepted by the Graduate School.
7. All language requirements, both for foreign languages and for competence in the use of English, must have been met.
8. The candidate must meet the professional and academic standards and have the personal qualifications appropriate to his field, as judged by the faculty of the relevant department.
9. The candidate must be recommended for the degree by his supervisory committee, his major department, and his college.
10. All requirements for the degree must be met while the student is a fully accepted graduate student (with the classification 7AS, 7ED, etc.) unless a specific statement to the contrary is made elsewhere in this *Catalog.*
11. If a student has been in continuous attendance (defined as registration in the Graduate School at least one quarter during each calendar year), he may graduate according to the curriculum under which he entered, provided the courses are still offered by the University.

Attendance at Commencement

Graduates who are to receive advanced degrees are urged to attend Commencement in order to accept personally the honor indicated by the appropriate hood. The student must arrange through the University Bookstore for proper academic costume to be worn at Commencement.

REQUIREMENTS FOR MASTER'S DEGREES

General Regulations

Course Requirements.—At least 50 per cent of the minimum course requirement for all master's degrees must be 600 level or above.

Residence.—For any master's degree the student in residence must spend at least three full-time quarters, or equivalent, as a graduate student at the University of Florida.

Nonresident county agents in the Agricultural Extension Service may use three three-week summer sessions for the purpose of satisfying the residence requirements for the degrees Master of Agriculture or Master of Science in Agriculture, but only if they have also spent one quarter in full-time resident graduate study on the campus at the University of Florida.

Supervisory Committee.—The Supervisory Committee for a student who is writing a thesis as part of his master's program must consist of at least two members as described below under *Master of Arts and Master of Science.* The committee for a student who is not writing a thesis may consist of one member who advises the student and oversees his program.

Examination.—A final comprehensive examination, oral, written, or both, must be passed by the candidate. This examination will cover at least the candidate's field of concentration, and in no case may it be scheduled earlier than six months before the degree is to be conferred.

Admission to Candidacy.—The student should apply for admission to candidacy through his department during the first two weeks of the quarter in which he expects to graduate. The Graduate Council reserves the right to deny degrees to persons who have failed to comply with this regulation at the proper time. Admission to candidacy is not automatic. *It requires a formal application distinct from registration.* The student must have a B average for all graduate work completed in order to be admitted to candidacy.

Transfer of Credits.—Courses of full graduate level to the extent of 9 quarter credits earned with an A or a B may be transferred from an institution approved for this purpose by the Graduate School. Acceptance of transfer credit requires approval of the student's supervisory committee and the Graduate Council. Nonresident or extension work taken at another institution (with the exception of work taken through the Board of Regents Office for Continuing Education) may not be transferred to the University of Florida for graduate credit.

TIME LIMITATION.—All work for the master's degree must be completed during the seven years immediately preceding the date on which the degree is to be awarded.

MASTER OF ARTS AND MASTER OF SCIENCE

Except as the following degrees are individually described hereafter, the requirements of the Master of Arts and Master of Science apply also to them: Master of Arts in Architecture, Master of Arts in Education, Master of Arts in Journalism and Communications, Master of Arts in Health Education, Master of Arts in Physical Education, Master of Arts in Teaching, Master of Fine Arts, Master of Science in Agriculture, Master of Science in Building Construction, Master of Science in Engineering, Master of Science in Forestry, Master of Science in Pharmacy, Master of Science in Statistics, and Master of Science in Teaching.

COURSE REQUIREMENT.—The minimum course work required for the master's degree with thesis is 45 credits, including no less than 36 credits of regular course work and up to 9 credits of the research course numbered 699 in all departments.

At least half the required credits of regular course work must be in a single field of study designated the major. If a minor is chosen, at least 8 credits of work are required; two 8-credit minors may be taken. Minor work must be in a department other than the major. In special cases this requirement may be modified, but only with the written permission of the Dean of the Graduate School.

The work in the major field must be in courses designed strictly for graduates (numbered 600 and above) or in undergraduate courses designated by the Graduate Council as available for graduate major credit. For the minor, courses numbered 300 and above may be taken. At least half of the required minimum of regular course work must be in courses numbered 600 and above.

THESIS.—Candidates for the master's degree with thesis are required to prepare and present a thesis (or equivalent in creative work) acceptable to their supervisory committees and the Graduate School. The candidate should consult the Graduate School office for instructions concerning the form of the thesis. The original copy of the thesis, bound with an abstract and accompanied by three loose copies of the abstract, must be in the office of the Dean of the Graduate School on or before the dates specified in the *University Calendar*. After the thesis is accepted, two copies will be permanently bound and deposited in the University Library.

LANGUAGE REQUIREMENTS.—(1) The requirement of a reading knowledge of a foreign language is left to the discretion of the student's supervisory committee or college. When a foreign language is required, the examination will be conducted by Educational Testing Service or by the Department of Foreign Languages; if an examination has already been passed at another institution, it must be validated at the University of Florida by the Department of Foreign Languages. If the student is majoring in a foreign language, that

language may not be used to satisfy this requirement. The foreign language requirement must be satisfied before the student is admitted to candidacy. (2) The ability to use the English language correctly and effectively, as judged by the supervisory committee, is required of all candidates.

SUPERVISORY COMMITTEE.—Upon the recommendation of the college concerned, a supervisory committee composed of at least two members selected from the Graduate Studies Faculty will be appointed for each student by the Dean of the Graduate School. If a minor is designated, it should be represented by one member of the committee. The committee should be appointed as soon as possible after the student has been admitted to the Graduate School and, in general, not later than the end of the second quarter of study. The Dean of the Graduate School is an ex officio member of all supervisory committees. The duties of the supervisory committee are to advise the student, to check on his qualifications and progress, to supervise the preparation of the thesis, and to conduct the final examination. No fewer than three faculty members must be present at the student's final examination, but only the members of the official supervisory committee are required to sign the thesis and the report of the final examination.

ADMISSION TO CANDIDACY.—Attention of students is directed to the fact that admission to candidacy is not automatic. It requires a formal application distinct from registration. Application for admission to candidacy for the master's degree should be made during the first two weeks of the term in which the student plans to graduate.

The Graduate Council may deny degrees to persons who have failed to comply with this regulation at the proper time. In order to be admitted to candidacy, the student must have (1) maintained a B average in registered course work, (2) passed a foreign language examination (if it is required in his curriculum), (3) chosen his thesis topic, (4) satisfied his supervisory committee, department chairman, and college dean that he is qualified to become a candidate for his degree. It is the responsibility of his supervisory committee at this time to make such investigation as is necessary to determine his eligibility.

FINAL EXAMINATION.—When all the student's course work is completed, or practically so, and the thesis is in final form, his supervisory committee is required to examine him orally or in writing on (1) his thesis, (2) his major subjects, (3) his minor or minors, and (4) matters of a general nature pertaining to his field of study. A written announcement of the examination must be sent to the Dean of the Graduate School. Using the form provided for the purpose the committee shall report in writing to the Dean of the Graduate School not later than one week before the time for conferring the degree whether all work has been completed in a satisfactory manner and whether on the basis of the final examination the student is recommended for his degree. This examination may not be scheduled earlier than six months before the degree is to be conferred without special approval of the Graduate Council.

NONTHESIS OPTION.—In certain majors, the Master of Arts and Master of Science degrees may also be earned without the preparation of a thesis. The minimum requirements for the nonthesis option are identical to those for the degree with thesis except that the student need not write a thesis, but must successfully complete 48 hours of regular course work (excluding credits for which grades of S and U are given) and, within six months before his degree is awarded, pass a comprehensive written examination on his major field of study and on his minor if a minor is designated. The supervisory committee for a nonthesis student may consist of one member of the Graduate Studies Faculty if there is no minor, but must include a representative of the minor field if one is designated. The duties of the committee are to advise the student, to check on his qualifications and progress, and to conduct or participate in conducting the comprehensive written examination.

MASTER OF ARTS IN TEACHING AND MASTER OF SCIENCE IN TEACHING

These degrees are designed for graduate students majoring in departments of the various colleges of the University who intend to teach in junior or four-year colleges. Requirements for admission are the same as those for the regular M.A. and M.S. degrees in the various colleges, and programs leading to the M.A.T. and the M.S.T. may, with proper approval, be incorporated into programs leading to the Ph.D.

The requirements for the degrees are as follows:

1. A reading knowledge of one foreign language if required by the student's major department.
2. Satisfactory completion of at least 54 credits of work while registered as a graduate student; at least 50 per cent of these credits must be 600 level or above, with work distributed as follows:
   a. At least 28 credits in the major and 8 credits in a minor.
   b. Nine credits in a departmental internship in teaching. Three years of successful teaching experience may be substituted for the internship requirement, and credits thus made available may be used for further work in the major, the minor, or in education.
   c. At least three courses, which may be used as the minor, in educational psychology, sociology, and curriculum dealing with the junior college. If any or all of these courses have been satisfactorily completed before the program is begun, the credits thus made available may be used for further work in the major, the minor, or in education.
3. At the completion of this degree, the student, for certification purposes, must present from his undergraduate and graduate degree programs no fewer than 54 quarter credits in his major field.
4. A final comprehensive examination, either oral or written or both, must be passed by the candidate. This examination will cover the candidate's field of concentration and his minor.

Master of Arts in Architecture

The degree of Master of Arts in Architecture is the professional degree for those students who wish to qualify for registration as an architect or for the teaching profession. It is designed to prepare the student in one of the specialized areas of architectural design, architectural history, architectural structures, urban design, environmental systems, or historic restoration and preservation.

The general requirements for the Master of Arts in Architecture are the same as those for other Master of Arts degrees with thesis except that the minimum registration required is 76 credits, including 9 credits in 699.

Master of Agriculture

The degree of Master of Agriculture is designed for those students who wish additional training before entering business occupations or professions, rather than for those interested primarily in research. The basic requirements, including those for admission, residence, supervisory committee, plan of study, and admission to candidacy, are the same as those outlined for the Master of Science in Agriculture degree, but the work requirements conform to the specific objectives of the Master of Agriculture degree.

Work Required.—A minimum of 48 credits of course work is required, of which at least 24 quarter credits shall be at the 600 level or above. If a departmental major is claimed, 18 credits must be in the major department, and consist of courses strictly for graduates (600 level) or undergraduate courses (500 level) approved by the Graduate Council for graduate major credit. Each student's program is designed to take into account the qualifications and needs of the individual and is subject to the approval of the supervisory committee. A thesis is not required, but the student must submit reports, term papers, and records of work accomplished. A comprehensive written qualifying examination, given by the supervisory committee, is required one quarter prior to graduation. Failure to qualify in this examination will require either the student's elimination from the program or additional course work. A final oral examination by the supervisory committee, covering the candidate's whole field of study, is required.

Limits on Off-Campus Work.—Credit for courses taken through the State Centers for Continuing Education as applied to the degree of Master of Agriculture is limted to 25 credits. Credit in extension courses (limited to 9 credits) from the University of Florida and Florida State University and credit transferred from another accredited institution reduce proportionately the credit accepted from the graduate residence centers.

For further details, inquire of the Dean of the College of Agriculture.

Master of Building Construction

The Master of Building Construction degree is designed for those students whose needs are better fulfilled by additional course work rather than the preparation of a thesis.

WORK REQUIRED.—The student must complete 50 credits of course work, of which at least 25 must be in the Department of Building Construction at the 600 level. The remainder may be in other departments in courses at the 300 level or above or in this department in courses specifically approved for graduate major credit. This remainder must be distributed in lots of no less than 9 credits in order to constitute either one or two minor areas. There is no foreign language requirement.

MASTER OF BUSINESS ADMINISTRATION

The requirements for the Master of Business Administration degree have been designed to give the student broad general preparation for managerial work, with emphasis upon developing his capacities and skills for business decision-making. A limited amount of specialization in one field is also required.

This degree is awarded upon the completion of a foundation program of 8 courses and a graduate program of 51 credits. The foundation program may be satisfied in whole or in part by appropriate undergraduate courses. A student having an undergraduate degree in business administration will normally need only 51 credits for the degree. He can, therefore, complete the requirements for the degree in a calendar year.

FOUNDATION PROGRAM.—The foundation program must include a minimum of 8 courses as follows:

Economic Principles	2 courses
Accounting	1 course
Quantitative Methods/Statistics	1 course
Business Law	1 course
Business Finance	1 course
Management	1 course
Marketing	1 course

(The accounting requirement may be met with ATG 510 (5 credits) or its equivalent. If the student presents the usual two-term introductory accounting course, the foundation program will total a minimum of 9 courses.)

THE GRADUATE PROGRAM.—Each candidate for the M.B.A. will take the following courses:

BS 679—Business Policy	4 credits
BS 690—Business Research and Reports	2 credits
BS 691—Business Research and Reports	2 credits
ES 615—Economics of Business Decisions	5 credits
ES 616—Economic Environment of Business	4 credits

The following courses are required of each candidate unless waived because of adequate course work (graduate or undergraduate) taken in the same area:

BS 610—Managerial Accounting	4 credits
BS 664—Managerial Statistics	4 credits
BS 671—Human Relations in Business	4 credits
MGT 570—Production Management Problems	5 credits

A candidate whose undergraduate work in quantitative methods does not meet the level of competence necessary for effective work in some of the required courses will be required to remedy this deficiency. At least 5 credits taken for this purpose may be counted for graduate credit.

CONCENTRATION.—Each candidate will select one field of concentration from the following: Accounting, Finance, Health and Hospital Administration, Insurance, Management, Marketing, Quantitative Analysis for Business, and Real Estate and Urban Land Studies.

In all areas except Health and Hospital Administration, the concentration consists of a minimum of 18 credits in approved courses. Of these 18 credits, at least 9 must be completed as a part of the graduate program and must be in courses approved for graduate major credit. When feasible at least one 4-credit course on the 600 level should be included in the concentration. A maximum of 9 credits in the concentration may have been completed for undergraduate credit or as a part of the foundation program. The required basic courses in accounting may not be used as a part of the concentration in accounting. The required basic courses in business finance, marketing, and production management may be used as a part of the concentration in each of these fields.

ELECTIVES.—Any elective courses will be selected from approved courses offered by the College of Business Administration.

CONCENTRATION IN HEALTH AND HOSPITAL ADMINISTRATION.—The Master of Business Administration degree with a concentration in Health and Hospital Administration is offered by the College of Business Administration. The course work in the area of concentration is offered by the Colleges of Health Related Professions, Law, and Engineering.

In addition to meeting the usual requirements for admission to the Graduate School, students who expect to enroll in this concentration must communicate directly with the Chairman of the Program in Health and Hospital Administration, who will arrange for a personal interview with members of a faculty selection committee. Since the number of students accepted for each class is limited, it may not be possible to consider applications submitted after April 1. Students are accepted for the Fall Quarter only.

Foundation course requirements are the same for this concentration as for all others. The following courses are required:

HA 600—Perspectives in Health	4 credits
HA 601—Hospital Organization, the Community and Patient Care	3 credits
HA 602—Financial Administration of Health and Hospital Care	3 credits
HA 610—Seminar in Health and Hospital Administration	4 credits
HA 611—Seminar in Health and Hospital Administration	2 credits

ISE 635—Health Systems Analysis 1	4 credits
LW 686—Hospital and Health Law Seminar	2 credits

In addition to the courses listed above, a research and practicum period of one quarter and an administrative residency of two quarters are required of all candidates in this concentration.

COMPREHENSIVE EXAMINATION.—In the latter part of the term in which the candidate expects to complete his course work, he will take his final comprehensive written and oral examination covering his entire program. Examinations for all M.B.A. degrees, including the Health and Hospital Administration concentration, are administered by an examining committee appointed from the graduate faculty of the College of Business Administration.

MASTER OF EDUCATION

PURPOSE.—This degree is designed to meet the need for professional personnel to serve the variety of functions required in established and emerging educational activities of modern society.

DESCRIPTION.—The minimum requirement for the M.Ed. degree is 50 credits in courses numbered 300 and above, with at least 25 of these credits at or above the 600 level.

CREDIT REQUIRED IN EDUCATION COURSES.—Either (1) a minimum of 32 credits in the M.Ed. program, of which at least 24 are at or above the 600 level; or (2) a total of 48 credits in the undergraduate and graduate program, but in no case fewer than 16 credits at or above the 600 level in the M.Ed. program.

CREDIT REQUIRED IN COURSES OUTSIDE EDUCATION.—Eight credits for students in the departments of Administration and Supervision, Counselor Education, Elementary Education, and Special Education; 24 credits for students in Secondary Education and Foundations of Education; only 8 credits, however, are required for those entering with deficiencies in Education.

CORE COURSES.—All M.Ed. programs include a core of required courses consisting of at least one course from two of the following four areas: General Curriculum; Psychological Foundations of Education; Social, Philosophical, Historical or Comparative Foundations of Education; Measurement or Statistics.

PLANNED PROGRAM.—Each student is required to submit a plan of study which shows acceptable balance and direction. The planned program must be approved by the student's counselor, the chairman of the student's area of specialization in Education, and the Office of Graduate Studies in Education during the first term of work or before. After the program has been developed, any change must be requested in writing and similarly approved.

RESIDENCE REQUIREMENT.—A minimum of 25 credits must be earned in residence on the Gainesville campus, including at least one quarter in full-time residence. Beyond these minimum residence requirements, credits earned in courses offered by the University of Florida off-campus may be accepted

toward degree requirements provided they are appropriate to the program planned for the degree.

Transfer of Credit.—Nine hours of approved graduate credit may be transferred from other institutions. This may be nonresidence credit only if earned in courses offered by institutions in the Florida State University System. No more than nine hours of credit from any source earned prior to admission to graduate school at the University of Florida may be counted toward the Master of Education degree.

Admission to Candidacy.—Admission to candidacy is recommended to the Graduate Council by the Graduate Committee of the College of Education during the first two weeks of the quarter in which the student expects to graduate. The student is responsible for filing application for admission to candidacy with the Office of Graduate Studies in Education when approximately one-half of the course work is completed and not later than one quarter prior to the completion of all requirements for the degree.

Evaluation of an application for admission to candidacy is based not only upon the student's academic record but also upon personal qualifications appropriate to his professional goals. On the basis of this evaluation a student may be recommended for admission to candidacy, recommended with special conditions or revisions of program, or denied admission and further registration as a graduate student.

With approval for admission to candidacy the student will be recommended for the degree upon the satisfactory completion of the remainder of his planned program.

Master of Engineering

The Master of Engineering degree is designed for those students whose needs are better fulfilled by additional course work rather than the preparation of a thesis. Requirements for admission are the same as those for the regular M.S.E. degree in the College of Engineering.

Work Required.—A minimum of 48 credits of coure work is required, with at least 27 credits in the student's major field. If a minor is chosen, at least 8 credits of work are required; two 8-credit minors may be taken. In addition, a multidisciplinary minor in departments other than the major may be authorized by the supervisory committee or program adviser. Major courses must be graduate level (numbered 600 and above) or courses approved for graduate major credit. Courses numbered 300 and above may be taken for the minor. At least 50 per cent of the required 48 credits must be in courses numbered 600 and above.

Degree Credit.—In order to qualify for course work toward the Master of Engineering degree, a student must first be admitted to the Graduate School at the University of Florida. The amount of course work toward this degree that may be taken at an off-campus center will depend upon the student's individual program and the courses provided through the center.

EXAMINATIONS.—Each student must pass a comprehensive written final examination at the completion of his course work. For the student whose program includes 27 credits of study taken on the Gainesville campus, this examination will be administered by the supervisory committee.

Other candidates must take a comprehensive written examination administered on the University of Florida campus by an examining committee recommended by the Dean of the College of Engineering and appointed by the Dean of the Graduate School. At least one member of the examining committee must be either the student's program adviser or a member of his supervisory committee. Another member must be chosen from outside the major department to represent the student's minor.

MASTER OF FINE ARTS

The degree of Master of Fine Arts is designed primarily for those who wish to prepare themselves as teachers of art in colleges and universities. It is the highest degree granted in the studio fields of the fine arts. Two years' residence is normally required for completion of requirements. Specialization is offered in ceramics, creative photography, drawing, painting, printmaking, and sculpture.

The requirements of the M.F.A. are the same as those for the Master of Arts with thesis except as follows:

1. The minimum registration required is 72 credits, including no fewer than 63 credits in regular course work and 9 credits in ART 699—Master's Research.

2. The course work must include ART 500—Methods of Research and Bibliography (4 credits), a minimum of 9 additional credits in the history and theory of art, and a minimum of 9 credits in a minor field. The remaining credits will be advanced studio courses in ceramics, creative photography, drawing, painting, printmaking, or sculpture.

MASTER OF HEALTH EDUCATION

The program leading to the degree of Master of Health Education is designed to meet the need for advanced preparation of health educators to serve in positions of leadership in schools and communities.

WORK REQUIRED.—A minimum of 51 credits of course work is required, of which at least 50 per cent must be graduate-level courses in health education. Of the remaining 50 per cent, at least three courses in health sciences must be taken outside the College of Physical Education and Health and courses from two of the following areas in professional education: curriculum, psychological foundations, social foundations, and measurement and statistics.

OFF-CAMPUS WORK.—The regulations governing the use of off-campus work are the same as those for the Master of Education degree.

SUPERVISORY COMMITTEE.—A Committee of five members of the faculty of the College of Physical Education, Health, and Recreation, with the Dean

of the College, or some person designated by him, serving as chairman and the Dean of the Graduate School as an ex officio member, will supervise the work of students registered in this program, subject to the approval of the Graduate Council.

Major Research Report.—A thesis is not required, but the candidate must prepare a major research report showing ability to define, investigate, present, and interpret a problem accurately and effectively.

Final Examination.—A final oral or written comprehensive examination will be administered by the candidate's supervisory committee.

Master of Nursing

The program leading to the degree Master of Nursing is designed to give students the basic knowledge and professional skills essential to the three areas of nursing activity: teaching, research, and practice. The diversity of roles that the nurse performs in these three areas necessitates a program that requires preparation in clinical, research, and functional activities. Traineeship grants and graduate assistantships for selected students are available. See *Financial Aid—Nursing.*

Work Required.—The minimum requirement of 50 credits is distributed in the following areas: general nursing, research, the functional area, electives, and the clinical specialty area. At least 50 per cent of the minimum course requirements must be in courses numbered 600 and above, and at least 50 per cent must be taken in the college of Nursing. There is no thesis or foreign language requirement.

Final Examination.—Each student must pass a comprehensive written or oral final examination during the final quarter of study. The examination will be administered by a committee of three, with a member of the graduate faculty of the College of Nursing as chairman. The examination will be confined largely to the student's major field of study.

Master of Physical Education

Work Required.—A minimum of 51 credits of course work is required, of which at least 50 per cent must be graduate-level courses in physical education. Of the remaining 50 per cent, at least three courses must be taken outside the College of Physical Education, Health, and Recreation.

Off-Campus Work.—The regulations governing the use of off-campus work are the same as those for the Master of Education degree.

Supervisory Committee.—A committee of the faculty of the College of Physical Education, Health, and Recreation, with the dean of the college, or some person designated by him, serving as chairman and the Dean of the Graduate School as an ex officio member, will supervise the work of students registered in this program, subject to the approval of the Graduate Council.

ADMISSION TO CANDIDACY.—Admission to this program is not a guarantee that the student will be admitted to candidacy for the degree. The student should apply for admission to candidacy no later than the beginning of the quarter in which he expects to graduate.

FINAL EXAMINATION.—The candidate must pass a final examination at the close of his course work. This written or oral examination will be confined largely to the student's major field of study.

MASTER OF REHABILITATION COUNSELING

The interdisciplinary program leading to the degree of Master of Rehabilitation Counseling is designed to give students basic knowledge and professional skills essential to the rehabilitation of physically, mentally, and emotionally handicapped persons. The diversity of activities performed by individuals who bear the designation of rehabilitation counselor in the various state, federal, and private agencies, necessitates a program that permits a basic foundation in counseling and guidance and, at the same time, allows for a sound preparation in the medical, socio-psychological and vocational implications of disability. Two basic qualifications are necessary for successful completion of the program: (1) the academic ability to accomplish the course requirements with satisfactory performance, and (2) the ability to work effectively with disabled people in a counseling relationship. Students interested in counseling the mentally retarded will be encouraged to specialize in this area through the utilization of certain elective course offerings and through the internship stage of their educational program. Traineeship grants for selected students are available. See *Financial Aid*.

WORK REQUIRED.—The minimum requirement is 63 credits, of which 39 represent required work in rehabilitation courses, including an internship. An additional minimum of 24 credits is selected from designated courses; i.e., 1 to 3 courses in each of the following areas: (1) statistics and measurement; (2) personality development; and (3) counseling. The selection of the courses in each of the three areas is made on the basis of meeting the individual needs of the student and is subject to the approval of a supervisory committee. At least 50 per cent of the minimum course requirements must be from courses numbered 600 and above.

INTERNSHIP IN MENTAL RETARDATION.—Students who are particularly interested in working with the mentally retarded may take a specialized internship in mental retardation at Sunland Training Center or other selected facilities in the State.

DEPARTMENTAL STUDY PROJECT.—A thesis is not required, but the candidate must complete an approved departmental study or research project as part of the degree requirements.

FINAL EXAMINATION.—Upon the satisfactory completion of all course work including the practicum and internship, each student must take a final written or oral departmental examination before the degree will be awarded. The

primary purpose of this examination is to determine the student's ability to relate the knowledge, skills, and techniques learned in the academic program to the more practical applications of working effectively with disabled individuals.

Master of Statistics

The minimum registration required for the Master of Statistics degree is 54 credits, including no less than 30 credits in the major field. Courses in the degree program will be selected in consultation with the major adviser and approved by the student's supervisory committee. One 9-credit minor is required. The work in the major field must be in courses approved for graduate major credit. For the minor, courses numbered 300 and above may be taken. At least half the 54 credits in regular course work must be in courses numbered 600 and above. The student will be required to pass, as judged by his supervisory committee, a comprehensive written examination covering the major and minor subjects. In addition, he will be examined orally on his major subjects.

For further details, inquire Chairman, Department of Statistics.

REQUIREMENTS FOR ENGINEER DEGREE

Industry has found that engineers holding either the master's or doctor's degree contribute significantly in highly sophisticated operational and developmental projects and missions which require engineering teams with an unusually high level of technical competence. Many of the projects and problems require education beyond the master's level, especially for those engineers who received their master's degree several years ago.

For those engineers who need additional technical depth and diversification in their education beyond the master's degree, the College of Engineering offers the degree of Engineer.

This degree requires a minimum of 45 quarter hours of graduate work beyond the master's degree and thus falls midway between the master's and Ph.D. in the amount of work required. No minimum residence requirement is stipulated. It is not to be considered as a partial requirement toward the Ph.D. degree. The student's objective after the master's degree should be the Ph.D. *or* the Engineer degree.

Admission to the Program.—To be admitted to the program students must have completed a master's degree in engineering at an accredited institution approved by the Graduate School of the University of Florida. The student must apply for admission to the Graduate School if he has not previously done so. The master's degree is regarded as the essential foundation for the Engineer degree.

Course and Residence Requirements.—A total registration in an approved program of at least 45 quarter credit hours beyond the master's degree

is required. This minimum requirement must be earned through the University of Florida. These credits may be completed in any graduate program administered by the College of Engineering, either in Gainesville or through GENESYS. The last 45 quarter credit hours must be completed within five calendar years.

SUPERVISORY COMMITTEE.—Each student admitted to the program will be advised and counseled by a supervisory committee. The committee consists of at least three members. At least two members are selected from the major department and at least one from a supporting department. All committee members will be members of the Graduate Studies Faculty. In addition, every effort should be made to have a representative from industry on each supervisory committee.

This committee should be appointed immediately after the student is admitted to the program. The committee is nominated by the department chairman, with the recommendation of the Resident Director as appropriate, approved by the Dean of Engineering, and appointed by the Dean of the Graduate School. The Dean of the Graduate School is an ex officio member of all supervisory committees and should be notified in writing in advance of all committee meetings.

This committee will inform the student of all regulations pertaining to the degree and his situation. If a thesis or report is a requirement in the plan of study then the committee will approve the proposed thesis or report and the plans for carrying it out. The committee will also conduct the final examination when the plan of study is completed.

PLAN OF STUDY.—The plan of study will permit from 9 to 15 quarter credit hours of thesis research in a course numbered 699. The thesis is not a requirement, but the option rests with the department involved and the supervisory committee. Each plan of study is developed on an individual basis for each student. Thus, there are no specific requirements for the major or minor; each student is considered as a separate case.

ADMISSION TO CANDIDACY.—The student must apply for admission to candidacy no later than the beginning of the term in which he is to graduate. If a thesis is required, the topic must also have been approved by his supervisory committee.

THESIS.—The thesis should represent performance at a level above that ordinarily associated with the master's degree. It should clearly be an original contribution; this may take the form of scientific research, a design project, or an industrial project approved by the supervisory committee. Work on the thesis may be conducted in an industrial or government laboratory under conditions stipulated by the supervisory committee.

FINAL EXAMINATION.—After the student has completed all work on his plan of study, the supervisory committee conducts a final comprehensive oral or written examination, which also involves a defense of the thesis if one is included in the program.

REQUIREMENTS FOR THE ED.S. AND ED.D.

THE ADVANCED SCHOOL OF THE COLLEGE OF EDUCATION offers programs leading to the degrees Specialist in Education, Doctor of Education, and Doctor of Philosophy. These programs are available in five areas: Administration and Supervision, Curriculum and Instruction, Foundations of Education, Counselor Education, and Special Education. The Specialist in Education degree is awarded for a two-year program of graduate study. The Doctor of Education degree requires writing a doctoral dissertation. Foreign languages are not required. The Doctor of Philosophy degree in the College of Education is described under *Requirements for the Ph.D.*

Programs leading to these degrees are administered through the Office of Graduate Studies in Education, which carries out the policies of the Graduate School and the graduate committee of the College of Education.

ADMISSION TO THE ADVANCED SCHOOL IN EDUCATION.—Admission to the Advanced School will be open only to persons who have:

1. Successfully completed 50 credits of professional course work in education. Applicants for admission to the Advanced School of the College of Education who meet all the requirements except for successfully completing 50 credits of professional education courses may be given provisional admission, and full admission when they have completed the required 50 credits.
2. Presented a record of successful professional experience, the appropriateness of which will be determined by the instructional department passing on the applicant's qualifications for admission. In some instances, departments may admit students with the understanding that further experience may be required before the student will be recommended for the degree.

Admission to the Advanced School will be based on the following criteria:

1. High scholastic average for previous graduate work (3.5 grade-point average or above, as computed at the University of Florida, will be considered evidence of good scholarship).
2. Satisfactory scores on the Aptitude Test of the Graduate Record Examination.
3. A personal interview or examination administered by the department or division in which the student seeks to specialize.

The judgment concerning admission of an individual student will be made according to the above criteria by the department in which he desires to specialize. The department will certify to the admissions committee that the student has met the criteria for admission to the Advanced School. In all cases the record, experience, and personal qualifications of the person applying for admission are subject to the approval of the admissions committee.

Where possible, students should seek admission to the Advanced School before enrolling in any courses beyond the master's degree. Where this procedure is impossible, the student will register in the Graduate School, and, during the first quarter of his work beyond the master's degree, will apply for admission to the Advanced School. If the candidate is found to be eligible, appropriate work taken during that term will be included in the planned program.

After completion of the master's degree any student approved by the admissions committee may register for courses, but admission to the Advanced School must be obtained before work may be counted for degrees or certificates above the master's level.

Specialist in Education

Primary emphasis in an Ed.S. program is placed on the development of the competencies needed for a specific job. Programs are available in the various areas of concentration within the departments of Administration and Supervision, Foundations of Education, and Counselor Education, the division of Cirriculum and Instruction, and Special Education. The Florida State Department of Education recognizes this degree for purposes of granting Rank 1A certification.

To study for this degree, the student must apply for and be admitted to the Advanced School of the College of Education. The student must also apply for and be admitted to candidacy for the degree no later than the term prior to that in which he intends to graduate. All work for the degree must be completed within seven years of admission to the Advanced School of the College of Education.

The Ed.S. degree is awarded at the completion of a planned program with a minimum of 100 credits beyond the bachelor's degree. All credits accepted for the program must contribute to the unity and the stated objective of the total program. Students who enter the program with an appropriate master's degree must meet the following requirements during the last 50 hours of the program:

1. 32 credits at the 600 and 700 levels.

2. At least 16 credits in professional education courses at the 600 level or above.

3. At least 2 quarters of full-time residence on campus in Gainesville. Of the last 50 hours, no more than 9 quarter hours of appropriate work from another institution offering a doctor's degree and 9 hours from off-campus courses offered by the University of Florida may be transferred to the program.

Students who enter the program with a bachelor's degree only must during their 100 credit program satisfy these requirements in addition to the requirements of the Master of Education or its equivalent.

A final written and oral examination is given by a committee selected by the department chairman during the last term. A thesis is not required; how-

ever, each program will include continuing attention to a research component which is relevant to the professional role for which the student is preparing.

Doctor of Education

The Doctor of Education degree is offered in administration and supervision, curriculum and instruction, foundations of education, counselor education, and special education. Each doctoral candidate is expected to achieve understanding of the broad field of education and competence in the area in which he chooses to specialize.

Admission to a program of work leading to the degree of Doctor of Education requires admission to the Advanced School of the College of Education, described previously, as well as admission to the Graduate School.

All courses beyond the master's degree taken at another institution, to be applied toward the Doctor of Education degree, must be taken at an institution offering the doctor's degree and must be approved for graduate credit by the Graduate School of the University of Florida.

Minors.—Minor work or work in cognate fields is required. If one minor is selected, at least 25 credits of work therein will be required; if two minors are chosen, one must have at least 18 credits of course work, the other at least 8 credits. Minors may not be taken in any branch of Education.

Courses in physical education approved by the College of Physical Education, Health, and Recreation and the Graduate School as subject matter or content courses may be used in the cognate work or as a minor.

In lieu of a minor or minors, the candidate may present a suitable program of no fewer than 25 credits of cognate work in at least two or more departments outside the College of Education. If two fields are included, there shall be no fewer than 8 credits in either field. If three or more fields are included, the 8-credit requirement for each field does not apply. This program must have the approval of the student's supervisory committee. The College of Education faculty will expect the candidate to be prepared to answer questions, at the time of his oral examination, in any of the areas chosen.

Admission to Candidacy.—Admission to candidacy for the degree of Doctor of Education rests on successful completion of the qualifying examinations and approval of a dissertation topic. Recommendation to the Graduate School for admission to candidacy is based on the action of the supervisory committee, subject to the approval of the graduate committee of the College of Education. The Florida State Department of Education recognizes this Admission to Candidacy for purposes of granting Rank IA certification.

The Qualifying Examination.—The applicant is recommended for the qualifying examination by his supervisory committee after he has completed sufficient course work.

The examination administered by the graduate committee of the College of Education consists of (1) a general section; (2) a field of specialization section; (3) examination in the minor or minors, where involved; and (4) an oral examination conducted by the applicant's supervisory committee.

RE-EXAMINATION.—If the student fails in his qualifying examinations he will not be given a re-examination unless such an examination is recommended for special reasons by his supervisory committee and approved by the Graduate Council. At least one quarter of additional preparation is considered essential before re-examination.

RESEARCH PREPARATION REQUIREMENT.—EDF 760—Methods of Educational Research, or its equivalent, for which a basic course in statistics is a prerequisite, is a minimum requirement in all programs. Additional requirements will vary with the department and with the student's plans for doctoral research.

For information relating to *Residence,* the *Supervisory Committee, Time Limitation,* the *Dissertation, Publication of the Dissertation,* and the *Final Examination,* the student is referred to the material presented under the heading *Doctor of Philosophy.* These statements are applicable to both degrees.

REQUIREMENTS FOR THE PH.D.

COURSE REQUIREMENTS

Doctoral study consists of the independent mastery of a field of knowledge and the successful prosecution of research. For this reason, doctoral students act, in large measure, on their own responsibility, and doctoral programs are more flexible and varied than those leading to lower degrees. The Graduate Council does not specify just what courses will be required for the Ph.D. degree, or how many. The basic general requirement is that the program should be unified in relation to a clear objective and that it should have the considered approval of the student's entire supervisory committee.

MAJOR.—The student working for the Ph.D. must elect to do his major work in a department specifically approved for the offering of doctoral courses and the supervision of dissertations. These departments are listed under *Graduate Programs.*

MINOR.—With the approval of his supervisory committee, the student may choose one or more minor fields. Minor work may be completed in any department, other than the major department, approved for master's or doctor's degree programs, as listed in this *Catalog.*

If one minor is chosen, the representative of the minor department on the supervisory committee shall suggest from 18 to 36 credits as preparation for a qualifying examination. Of course, a part of this background may have been acquired in the master's program. If two minors are chosen, each must include at least 12 credits. Competence in the minor area may be demonstrated through a written examination conducted by the minor department or through the oral qualifying examination.

Course work in the minor at the doctoral level need not be restricted to the courses of one department, provided that the minor has a clearly

stated objective and that the combination of courses representing the minor shall be approved by the Graduate School before registration beyond 6 credits of course work applicable to the minor. This procedure is not required for a departmental minor.

Supervisory Committee

Supervisory committees are nominated by the department chairman, approved by the dean of the college concerned, and appointed by the Dean of the Graduate School. The committee should be appointed as soon as possible after the student has begun doctoral work, and in general no later than the end of his third quarter of equivalent full-time study. The Dean of the Graduate School is an ex officio member of all supervisory committees and should be notified in writing well in advance of all examinations conducted by such committees.

Duties and Responsibilities.—The duties of the supervisory committee are as follows:

1. To inform the student of all regulations governing the degree sought. It should be noted, however, that this does not absolve the student from the responsibility of informing himself concerning these regulations. (See *Student Responsibility*.)
2. To meet immediately after appointment to pass on the qualifications of the student and to discuss and approve a program of study for him.
3. To meet to discuss and approve the proposed dissertation project and the plans for carrying it out.
4. To conduct the qualifying examination or, in those cases where the examination is administered by the department, to take part in it. In either event, no fewer than five faculty members shall be present for the oral portion of the examination.
5. To meet when the work on the dissertation is at least one-half completed to review procedure, progress, and expected results, and to make suggestions for completion.
6. To meet when the dissertation is completed to conduct the final oral examination and to satisfy itself that the dissertation is a piece of original research and a contribution to knowledge. No fewer than five faculty members shall be present for this examination, but only the members of the official supervisory committee are required to sign the dissertation.

Membership.—The supervisory committee for a candidate for the doctoral degree shall consist of no fewer than three members selected from the graduate faculty. At least two members will usually be from the college or department recommending the degree, and at least one member will be drawn from a different educational discipline. The chairman and at least one additional member of the committee will be members of the resident Doctoral Research Faculty of the University of Florida.

If a minor is chosen, the supervisory committee will include at least one

person from outside the discipline of the major for the purpose of representing the student's minor. In the event that the student elects more than one minor, each minor area may, at the discretion of the departments concerned, be represented on the supervisory committee.

When a minor is not designated, the supervisory committee will include at least one person from outside the discipline of the major who has been appointed to the graduate faculty. The Graduate Council desires each supervisory committee to function as a university committee, as contrasted with a departmental committee, in order to bring university-wide standards to bear upon the various doctoral degrees.

In unusual cases the doctoral research may require the guidance of a specialist from an area of study other than that of the chairman of the supervisory committee. In such cases the department chairman may recommend appointment of a chairman and a co-chairman, with the latter being a member of the graduate faculty, but not necessarily of the Doctoral Research Faculty. A co-chairman may also be appointed for the purpose of serving during a planned absence of the chairman; in this case both the chairman and the co-chairman shall have been appointed to the Doctoral Research Faculty.

Language Requirement

A Ph.D. student is required to demonstrate proficiency in a language other than his native tongue. This language will normally be French, German, Russian, or Spanish, the choice to be made by the supervisory committee. A student may not, however, use a language in which he is majoring to satisfy the language requirement. Proficiency in the language is to be demonstrated in one of the following ways:

1. By satisfactory performance on the nationally administered Graduate School Foreign Language Test of the Educational Testing Service, which the student is encouraged to take before entering Graduate School or as soon as possible thereafter.
2. By completing a fourth quarter of a foreign language with a grade of A or B at the University of Florida.
3. For students with a native language other than English, by satisfactory performance on the Test of English as a Foreign Language.

The language requirement must be met before the student can be admitted to the qualifying examination.

The foreign language departments offer special classes for graduate students who are beginning the study of a language. See the current *Schedule of Courses* for the languages in which this assistance is available.

Some colleges or departments may have language requirements in addition to the general requirement of the Graduate School. A student should consult the chairman of his supervisory committee or his departmental adviser about such requirements.

Residence

The minimum residence requirement for a doctor's degree is nine quarters of full-time resident graduate study, or equivalent, at institutions approved by the Graduate School. Candidates in the College of Agriculture may do their research at certain branch stations of the University of Florida Agricultural Experiment Station where adequate staff and facilities are available.

A quarter of residence is earned for every 15 credits of course, thesis, and dissertation work (excluding courses numbered 697 and 698), except that no more than 1 quarter's residence can be earned in a single quarter. Students holding assistantships or employment of any kind are required to reduce their study loads and consequently their residence credit, as indicated under *Study Loads*.

The doctoral program also requires a period of concentrated study on the Gainesville campus of the University of Florida. Normally this requirement is satisfied by three consecutive quarters of full-time study beyond the master's degree or an equivalent period of graduate study. Part-time study may be used to satisfy the concentration requirement if: (1) 45 credits are earned in one calendar year; or (2) 52 credits are earned in six successive registrations (either including or excluding summer registration).

In some cases a student may be employed on a sponsored project from which his thesis or dissertation will be drawn. Upon written recommendation of the chairman of the supervisory committee, residence credit may be permitted for the time devoted to such research. This recommendation must be made during the quarter in which the work is done. All time devoted to routine duties, or to research not related directly to the dissertation or thesis, should be removed from consideration.

Qualifying Examination

The qualifying examination, which is required of all candidates for the degree of Doctor of Philosophy, may be taken during the third term of the second year of graduate study but cannot be taken before the language requirement has been met. The examination, conducted by the supervisory committee, with the aid of the major and minor departments, is both written and oral and covers the major and minor subjects. At least five faculty members must be present at the oral portion of this examination. The supervisory committee has the responsibility at this time of deciding whether the student is qualified to continue his work toward the Ph.D. degree.

If the student fails in his qualifying examination, he will not be given a re-examination unless such an examination is recommended by his supervisory committee and approved by the Graduate School. At least a quarter of additional preparation is considered essential before re-examination.

An announcement of the scheduling of each student's qualifying examination must be submitted in writing to the Dean of the Graduate School. If the student does not file for admission to candidacy immediately after his qualify-

ing examination, a written report of the result of his examination must be filed with the Graduate School Office.

TIME LAPSE.—Between the qualifying examination and the date of the degree, there must be a minimum of two quarters if the candidate is in full-time residence, or three quarters if the candidate is on less than a full-time basis. The quarter in which the qualifying examination is passed is counted, provided that the examination occurs before the midpoint of the term.

TIME LIMITATION.—All work for the doctor's degree must be completed within five calendar years after the qualifying examination, or this examination must be repeated.

ADMISSION TO CANDIDACY

A graduate student does not become an actual candidate for the Ph.D. degree until he has been formally admitted to candidacy. Such admission requires the approval of the student's supervisory committee, the chairman of his department, his college dean, and the Dean of the Graduate School. The approval must be based on (1) the academic record of the student, (2) the opinion of his supervisory committee concerning his overall fitness for candidacy, (3) an approved dissertation topic, and (4) a qualifying examination as described above. Application for admission to candidacy is normally made as soon as the qualifying examination has been passed.

DISSERTATION

Every candidate for a doctoral degree is required to prepare and present a dissertation that shows independent investigation and is acceptable in form and content to his supervisory committee and to the Graduate School. Since all doctoral dissertations will be published by microfilm or as books or monographs, it is necessary that the work be of publishable quality and that it be in a form suitable for publication. The original copy of the dissertation must be presented to the Dean of the Graduate School on or before the date specified in the *University Calendar.* It must have an abstract bound with it and be accompanied by four loose copies of the abstract.

PUBLICATION OF DISSERTATION.—All candidates for the Ph.D. and Ed.D. degrees are required to deposit the sum of $25 with Student Accounts, the Hub, for microfilming their dissertations and to sign an agreement authorizing publication by microfilm. If the Graduate School is notified in advance that the dissertation will appear as a book or monograph,* and if it is so published in essentially complete form within two years, the Graduate Council will

* A monograph is defined by the Graduate School as a small book devoted to one subject, published under its own cover, listed in either the *Cumulative Book Index* or the *Publisher's Weekly,* and cataloged in accordance with standard American library practices as a separate book. Reprints of articles do not fulfill this definition.

consider a request for refund of the microfilming fee upon receipt of five copies. Proper reference to the dissertation must be given in the publication. Unless the candidate presents evidence of acceptance of the dissertation for such publication by the end of the two-year period, the Graduate Council will automatically authorize publication of the dissertation by microfilm.

COPYRIGHT.—The student may choose to copyright his microfilmed dissertation for a charge of $15.

FINAL EXAMINATION

After submission of the dissertation and the completion of all other prescribed work for the degree, but in no case earlier than six months before the conferring of the degree, the candidate will be given a final examination, oral or written or both, by his supervisory committee. At least five faculty members must be present at the oral portion of this examination. An announcement of the scheduled examination must be sent to the Dean of the Graduate School. Satisfactory performance on this examination completes all requirements for the degree.

EXPENSES

APPLICATION FEE

Each application for admission to the University must be accompanied by an application fee of $15. Application fees are nonrefundable. Further instructions will be found in the Admissions section of this *Catalog*.

CLASSIFICATION OF STUDENTS—FLORIDA OR NON-FLORIDA

For the purpose of assessing fees, applicants are classified as Florida or non-Florida students. A Florida student is a person who has been a citizen of the United States or a resident alien and who has resided and had his permanent home in the State of Florida for at least twelve months immediately preceding his current registration. If the student is an unmarried minor, his parents or legal guardians must meet the foregoing residence requirements. All other persons are non-Florida students. A written statement concerning residence must be made under oath at the time of application for admission.

In determining Florida residence for the purpose of assessing fees, the burden of proof is on the applicant. Under law an applicant can change his place of residence from another state to the State of Florida only by actually and physically coming into the State and establishing his residence with the intention of permanently residing within the State. The legal residence of the wife is that of the husband, and the legal residence of a minor is that of his parents or legal guardian.

A non-Florida student may apply in writing for reclassification after he or, if a minor, his parents have resided in Florida for twelve months, have filed a declaration of intent to become residents of the State, and are registered to vote in the State. An alien must have resided in Florida for twelve months and must present U.S. Immigration and Naturalization certification that he is a resident alien. If the application is supported by evidence satisfactory to the University that the student qualifies as a Florida student, his classification will be changed for future registrations.

Registration and Instructional Fees

The *University Calendar* appearing at the front of this *Catalog* sets forth the beginning and ending dates of each quarter.

The following fees and charges are proposed at this time. However, since the *Catalog* must be published considerably in advance of its effective date it is not always possible to anticipate changes and the fee schedule may be revised. Every effort will be made to publicize changes for any quarter in advance of the registration date for that quarter.

Fees are payable on the dates listed in the *Catalog* or the date given on the statement sent those participating in advance registration. Payment of fees is an integral part of the registration process. Registration (including payment of fees) must be completed on or before the proper due date. Mail payments must be received at Student Accounts, the Hub, by that date. All payments, whether for full- or part-time students, received after the due date are subject to a $25 late fee. The fees charged are based on the classification of a student as Florida or non-Florida, full-time or part-time. Unless otherwise noted, the fees for each quarter include fees for matriculation, student health services, student activities, and a general building fee.

Fees are assessed graduate students as follows:

A Full-Time (seven credits or more) Florida Student will pay a fee of $175 for each quarter for which he is enrolled.

A Full-Time (seven credits or more) Non-Florida Student will pay fees of $475 for each quarter for which he is enrolled. ($175 Registration plus $300 Non-Florida Fee.)

A Part-Time Florida Student, enrolled for six credits or less, will pay, per quarter, a fee of $16 per credit. He will not be entitled to Student Activity or Infirmary privileges.

A Part-Time Non-Florida Student, enrolled for six credits or less, will pay, per quarter, a fee of $41 per credit ($16 plus $25). He will not be entitled to Student Activity or Infirmary privileges.

A student, Florida or Non-Florida, enrolled for thesis only, not to exceed six credits, will pay a fee of $16 per credit. (Minimum graduate registration is 3 credits.) He will not be entitled to Student Activity or Infirmary privileges.

Graduate Engineering Education System (GENESYS)

A student enrolled in GENESYS will pay a fee of $40 per credit. The maximum fee is $250.

Students enrolled in GENESYS are not entitled to Student Activity or Infirmary privileges.

University policies concerning application and late fees also apply to GENESYS, except that the $25 late fee will not be assessed during the first week of classes.

Special Fees

Audit Fee.—A regularly enrolled full-time student may audit courses without payment of an additional fee. Other graduate students will pay a fee of $16 per credit. Auditor's permit forms may be obtained in the Office of the Registrar. Fees are payable at Student Accounts, the Hub.

Graduate Record Examination.—The Aptitude Test of the Graduate Record Examination is required for admission to the Graduate School. A fee of $8 covers the cost of this examination. Students who take one of the Advanced Tests of the Graduate Record Examination in combination with the Aptitude Test pay a fee of $16. These fees are payable to the Educational Testing Service, Princeton, New Jersey 08540.

Graduate School Foreign Language Test Fee.—All students wishing to be certified as proficient in a reading knowledge of French, German, Russian, or Spanish must take the Educational Testing Service (ETS) Graduate School Foreign Language Tests. A fee of $10 covers the cost of each examination. This fee is payable to the Educational Testing Service, Princeton, New Jersey 08540.

Library Binding Fee.—Each candidate for a degree with a thesis or dissertation must pay a fee of $8 for the permanent binding of the two copies of his thesis or dissertation deposited in the University Library. This fee is due by the date specified in the *Calendar* in the quarter in which the degree is to be awarded and is payable at Student Accounts, the Hub. A copy of the receipt for the fee must be presented at the Graduate School office.

Microfilm Fee.—A fee of $25 is charged for the publication of the doctoral dissertation by microfilm. This fee is payable at Student Accounts, the Hub, and is due by the date specified in the *Calendar* in the quarter in which the degree is to be awarded. A copy of the receipt for the fee must be presented at the Graduate School office.

Prepayments—University Housing

Applications for assignment to University housing facilities for single or married students must be accompanied by a payment of $10. This payment is nonrefundable. It will be credited against the first rental payment.

Refund of Fees

Fees will be refunded under certain conditions upon presentation at Student Accounts, the Hub, of a Registration Status form issued by the Registrar and the current Certificate of Registration. No refund will be made under this policy except upon proper application.

A full refund of tuition, registration, and instructional fees will be made if a student withdraws from the University or if his registration is cancelled by the University on or before the final day of the drop-and-add period.

No refund will be made if the student withdraws after the final day of the drop-and-add period.

Commensurate refunds will be made to part-time students.

Deductions will be made from refunds for unpaid accounts due the University.

Past Due Student Accounts

All student accounts are due and payable at Student Accounts, the Hub, when charges are incurred.

Delinquent accounts will be considered sufficient cause for cancellation of registration, as University regulations prohibit registration, graduation, granting of credit, or release of transcript for any student whose account with the University is delinquent.

Traffic and Safety Regulations

All students must register their automobiles or motorcycles at the University Traffic and Parking Department during their first registration period at the University. There is a fee for registration and a schedule of fines for on-campus vehicle violations. A complete set of rules governing traffic, parking, and vehicle registration may be secured at the office of Traffic and Parking, the Hub. Each student should familiarize himself with these regulations upon registering at the University.

HOUSING

For Married Graduate Students.—Apartment accommodations on the University campus are available for some married graduate students, but there is currently a four- to ten-month waiting period between application and assignment, depending on the assignment period requested.

For Single Graduate Students.—Two modern, air-conditioned residence halls are reserved exclusively for upper-division and graduate students, one hall for men and one for women. Sections of an additional residence hall for graduate men are also available.

Housing agreements for all single students are for the agreement year of four quarters (September to August), if enrolled.

Applications

Each student must make personal arrangements for his housing, either by applying to the Office of the Director of Housing for assignment to University housing facilities or by obtaining accommodations in private housing. All inquiries concerning University housing facilities should be addressed to the Director of Housing, University of Florida, Gainesville 32601.

An application for housing may be filed at any time after application for admission to the University. Prospective students are urged to apply as early as possible because of the housing demand.

Graduate students living in University housing are required to qualify as full-time students as defined by their college or school, and they must continue to make normal progress toward a degree as determined by the head of their college or school.

Roommate requests are honored wherever possible, provided the individuals wishing to room together submit their applications at the same time, clearly indicate on their respective applications their desire to room together, and are within similar academic classifications. Any student interested in a room assignment with a foreign student should indicate this preference on his application.

Residence Halls for Single Students

Certain floors of the new Twin Towers residence hall (one hall for men and one hall for women) are designated for graduate students. Eight suites accommodating four students each are located on each floor. A suite includes two bedrooms, a private bath, and a study-kitchenette room. The rooms provide several study locations so that students studying will not disturb students sleeping. The kitchenettes, with a refrigerator and range, allow students to prepare light meals. The Towers are entirely carpeted and air-conditioned. Other special features for residents include a library, social room, sundry shop, and lounges, as well as laundry, vending, and seminar rooms. The quarterly rent rate, including utilities and linen rental, is $156 per student. This rate is subject to change.

Facilities for Married Couples

The University operates four apartment villages for married students. To be eligible to apply for and occupy apartment housing on-campus, the following requirements must be met:

The married student must meet the requirements for admission to the University of Florida, qualify as a full-time student as defined by his college or school, and continue to make normal progress toward a degree as determined by the head of his college or school.

The married student must be part of a family unit, defined as husband and wife with or without children. No relatives or housekeepers can be included as part of the family unit. In view of the limited size of on-campus apartments, applications from families having more than four children cannot be accepted.

The married student must be part of a family with a combined gross annual income (including grants-in-aid, scholarships, fellowships, and grants) which does not exceed, during the period of occupancy, the following maximum income limitations:

2 Persons	3 & 4 Persons	5 & 6 Persons
$5,500	$6,400	$7,350

Since on-campus apartments are intended to provide relatively low-cost housing for married students, a family with a combined gross annual income in excess of the above scale cannot apply for or occupy an apartment except in unusual circumstances. Exceptions may be granted only by the Committee on Student Housing.

Flavet Village III, of temporary frame construction, is being phased out. No new applications for this area are being accepted.

Corry and Schucht Memorial Villages, of modern brick, concrete, and wood construction, contain almost an equal number of one- and two-bedroom apartments, with a few three-bedroom units in Corry Village only. These apartments are furnished with basic equipment in living room, kitchen, dining area, and one bedroom. No furniture may be removed from apartments in Corry and Schucht. Rent rates (subject to change) are currently $60, $65, $70, and $75 per month. Applications for the three-bedroom units may be made only by current residents.

Diamond Memorial Village consists of 208 apartments similar in construction, furnishings, and equipment to those in Corry and Schucht Villages. Special features include a community building with air-conditioned study-meeting room, and a study cubicle in each two-bedroom apartment. Rent rates (subject to change) are currently $60 and $70 per month for one- and two-bedroom apartments, respectively.

Residents in all villages must furnish their own linens, dishes, rugs, curtains, and similar items. Utilities are an extra expense.

Off-campus Housing

To aid students in obtaining private rental housing, the Housing Division maintains an Off-Campus Section. All inquiries about off-campus housing should be mailed to the Head of Off-Campus Housing, Division of Housing, University of Florida, Gainesville 32601.

Off-campus listings are maintained in the Off-Campus Section but are not compiled for mailing, since availability changes frequently and a mutually satisfactory rental arrangement can usually be made by the student only after personal inspection of facilities and a conference with the householder. Students seeking off-campus housing should come to Gainesville well before the school period to confer with the Off-Campus Section about accommodations. Advance office appointments may be made.

FINANCIAL AID

Qualified graduate students in every department are eligible for a number of fellowships, assistantships, and other awards. In general, such awards are available to students pursuing either a master's or a doctoral degree. Unless otherwise specified, all applications for financial support should be made to the chairman of the appropriate department, University of Florida, by February 15 of each year.

Fellows and Graduate Assistants with at least one-third time appointments will pay registration fees of $175 per quarter, the additional non-Florida fees being waived. Degree seeking Fellows and Trainees are expected to devote full time to their studies, and their stipend is "excludable from income for tax purposes." Graduate Assistants, who have part-time teaching or research duties, must register for appropriately reduced study loads; income received for their services is subject to withholding tax, but some students may be eligible to claim a tax refund under current regulations of the Internal Revenue Service.

Postdoctoral Fellowships are also available in many departments.

University-wide Awards

Graduate Council Fellowships are available annually to meritorious students at stipends ranging from $2,700 to $3,240 for a nine-month period plus the waiver of out-of-state fees of $900. These awards are open to candidates in any field of graduate study or research and require no service.

Non-Florida Fee Scholarships are available to a limited number of graduate students and are made on the basis of scholarship achievement. These awards of $300 a quarter do not cover registration fees of $175.

One-Fourth-Time Assistantships provide a stipend from $1,800 to $2,250 for nine months. Assigned duties in teaching or research amount to 12 hours a week. Registration is limited to 12-15 credits.

One-Third-Time Assistantships provide a stipend from $2,574 to $2,934 for nine months plus waiver upon request of out-of-state fees of $900. An academic year of graduate residence may be completed in 4 quarters. Fifteen hours a week are devoted to duties in teaching or research. Registration is limited to 9-14 credits.

One-Half-Time Assistantships provide a stipend from $3,420 to $3,780 for nine months plus waiver upon request of out-of-state fees of $900. A year of graduate residence may be completed in 5 quarters. Assigned duties may amount to 20 hours a week. Registration is limited to 8-11 credits.

Interested students should inquire at their department offices concerning the availability of assistantships and the procedure for making application. Prospective students should write directly to the chairman of their major de-

partments as well as to the Admissions Office. *Early inquiry is essential in order to be assured of meeting application deadlines.* Appointments are made on the recommendation of the department chairman, subject to admission to the Graduate School and to the approval of the Dean of the Graduate School. Clear evidence of superior ability and promise is required. Reappointment to assistantships requires evidence of continuation of good scholarship.

Peace Corps Awards

In encouraging Peace Corps returnees to pursue an advanced degree, the Graduate Council has designated two fellowships for 1971-1972 which will be used for well-qualified Peace Corps applicants.

National Defense Education Act Fellowships

Title IV NDEA Fellowships.—The University is approved for the award of NDEA Title IV Fellowships through a large number of departments in the colleges of Agriculture, Arts and Sciences, Business Administration, Education, Engineering, and Medicine. These are three-year doctoral fellowships with stipends ranging from $2,400 to $2,800 for twelve months plus out-of-state tuition of $1,200, registration fees of $700, and $500 dependency allowances.

Apply to the appropriate department by February 15th.

Title VI NDEA Fellowships.—These are available for students whose proposed programs emphasize the learning of either Spanish or Portuguese through courses in the language or, in the case of doctoral candidates working on the dissertation, through research dealing with the language or research in which the language is an indispensable tool. Fellows are expected also to study other fields needed for a fuller understanding of the area, region, or country in which such language is commonly used. These related studies may include such fields as anthropology, economics, geography, history, linguistics, literature, political science, and sociology.

The basic stipend will comprise the cost of tuition and all required fees, plus $450 for summer study only, or $2,250 for the academic year, and $2,700 for summer and academic year. A candidate may apply for an allowance for up to four dependents. This allowance for each dependent is $500 for three quarters.

National Science Foundation Graduate Traineeships

Doctoral Programs: NSF Graduate Traineeships are awarded in a variety of fields in the colleges of Agriculture, Arts and Sciences, Engineering, and Medicine. Trainees are eligible for reappointment for a second year for the master's degree and for up to four years for the doctorate.

Stipends include $2,400 to $2,800 plus out-of-state tuition of $1,200 and

registration fees of $700 for 12 months plus $500 for a dependent spouse and each dependent child.

NDEA-related Fulbright-Hays Graduate Fellowships for Study Abroad

The purpose of this program is to enable graduate students who plan to teach in U. S. institutions of higher education to undertake non-Western language and area study and research abroad.

In general, Fellows will be expected to study in the world area of their academic interests during their periods abroad, and Fellows following a full-time program of formal study will normally be expected to carry on their studies in a single country. In certain cases, however, approval may be given for dissertation research which would involve (a) visits to several countries, or (b) study outside the geographic area involved if it is demonstrated that specialized or superior research facilities exist elsewhere.

Stipends will be individually computed on the basis of the cost of living in the foreign country. The award will also cover travel expenses, fees for tuition which the Fellow may need to carry out his approved program, and an allowance to help him meet the cost of research and incidental expenses.

Dependency allowances will be provided for up to four dependents at the rate of $150 a month for the first dependent and $75 a month for each additional dependent.

United States Steel Foundation Fellowships

A two-year fellowship is awarded in even-numbered years by the United States Steel Foundation to an outstanding student pursuing the doctoral degree. This fellowship, which provides a total stipend of $4,800, is offered in recognition of the increased needs for superior leadership in all elements of national life; it provides for advances in quality scholarship in science and technology, social sciences, and humanities.

Agriculture

H. Harold Hume Fellowship of the Florida Federation of Garden Clubs.—This fellowship, established by the Florida Federation of Garden Clubs, has for its object the investigation of special problems of ornamental horticulture in Florida. The work is under the direction of the Department of Ornamental Horticulture. The fellowship carries a stipend of $2,700 annually.

Education

Many graduate students in Education receive financial aid through assistantships and traineeships made available by federal and foundation grants for research and special programs. The number and nature of these awards

vary with each academic year and during the year. Qualified students interested in financial support should maintain contact with the Office of Graduate Studies in Education.

Engineering

Financial aid to graduate students in engineering is available through nearly 200 awards in research and teaching, requiring one-third to three-quarter work loads with stipends of $286 per month and up. Approximately 100 traineeships and fellowships are available with stipends ranging from $2,700 to $2,800 plus tuition. These are supported by the National Science Foundation, the Atomic Energy Commission, the National Institutes of Health, the National Defense Education Act Title IV, the University of Florida Graduate School, and the College of Engineering. Information regarding application for these positions may be obtained from the Director, Engineering and Industrial Experiment Station, College of Engineering.

Shands-Baker Corporation provides two one-year research fellowships with a stipend of $250 per month for Civil Engineering students pursuing a Master of Science in Engineering.

Health and Hospital Administration

Traineeship Grants.—The Social and Rehabilitation Service of the United States Department of Health, Education, and Welfare has made available a substantial number of traineeships for students interested in becoming administrators of rehabilitation facilities. In addition, the department offers several Public Health Service traineeships for eligible students. These traineeships carry a tax-free stipend of $2,400 per year and pay tuition and fees plus dependency allowance.

For further information regarding these traineeship grants contact: Chairman, Graduate Program in Health and Hospital Administration, University of Florida, Gainesville, Florida 32601.

Medicine

Predoctoral fellowships and part-time assistantships and research positions are available for graduate students in the various basic medical science departments participating in the Ph.D. program. In addition some clinical and basic science departments offer postdoctoral fellowships to a selected number of recent graduates of the M.D. or Ph.D. program who wish extensive research experience in these disciplines.

Nursing

Traineeships are available through the College of Nursing, by grants from the National Institute of Mental Health and the U. S. Department of Health, Education, and Welfare, to applicants admitted to full graduate status. Stipends

range from $2,400 to $3,600, depending upon the amount of experience the candidate has had in nursing. In addition, non-Florida fees and registration fees are paid.

Other federal and state agencies, foundations and health groups, as well as the military services, offer financial assistance. Loan programs with deferred interest, repayment, and reduction features are also available. A more complete list including details and requirements will be furnished upon request.

A number of graduate assistantships are also available through various project grants received by the College of Nursing. Application should be made to the Assistant Dean for Graduate Education, College of Nursing, University of Florida, Gainesville, Florida 32601.

Pharmacy

American Foundation for Pharmaceutical Education Fellowships.—A number of graduate fellowships are offered by the American Foundation for Pharmaceutical Education which carry stipends up to $2,400. In addition, allowances up to $600 may be granted annually for academic expenses. Holders of these fellowships may pursue graduate work at the University of Florida. Application should be made to the Foundation, 777 14th Street, N.W., No. 630, Washington, D.C. 20005.

Psychology

Financial support is available to assist students to pursue postgraduate work leading to the master's or doctor's degree. In addition to University-wide awards, current financial assistance includes U.S. Public Health Traineeships, Florida Mental Health Fellowships, Graduate Teaching and Research Assistantships, and the Center for Neurobiological Sciences Fellowships. For information write the Chairman of the Stipend Committee, Department of Psychology.

Rehabilitation Counseling

Traineeship Grants.—The U. S. Rehabilitation Services Administration has allotted the University of Florida a substantial number of traineeships for full-time students preparing to become rehabilitation counselors. In addition a small number of traineeship grants are available for selected students who wish a greater emphasis on problems associated with counseling the mentally retarded. The traineeship grants for work toward the master's degree carry a stipend of $1,800 for the first year of graduate study and $2,000 for the second year. In addition to these stipends, non-Florida fees and registration fees are paid. A limited number of grants are available for work beyond the master's level and carry larger stipends. Traineeships are awarded for a full calendar year and may be renewed for a second year.

For further information regarding the degree program and traineeship

grants contact: Chairman, Department of Rehabilitation Counseling, College of Health Related Professions, University of Florida, Gainesville, Florida 32601.

Speech

The Department of Speech administers a number of traineeships, fellowships, and assistantships from such sources as the National Institutes of Health, Rehabilitation Services Administration, NDEA Title IV, U. S. Office of Education, Alachua County Easter Seal Society, and the University of Florida.

Additional information may be obtained from the chairman of the Department of Speech.

Loans

Long term loans are available to graduate students from four basic sources: United Student Aid Funds, Federally Insured Loans, University of Florida Long Term Loans, and Florida State Loans. Application should be made to the Student Financial Aid Office between November 1 and February 28 for the following academic year. No deadline exists for the Federally Insured Loan and the United Student Aid Fund Loan.

SPECIAL PROGRAMS

International Studies

Florida stands as a bridge between the United States and other nations. Geographically like an arm jutting into the sea, the State has prospered during its history under the flags of four nations. The first Europeans arrived in Florida in 1513, and St. Augustine, founded 42 years later, is the oldest city in the nation. In the present century, the State has become a major port of entry for the entire country. The radio, newspapers, and business of Florida represent the United States internationally, and the life of its citizens draws on the traditions of many peoples.

As the leading institution of higher education in the state, the University of Florida has long been aware of Florida's unique international position. By the beginning of this century, the University had begun to focus its attention on the Latin American nations. Advanced degrees were given in Latin American studies as early as 1927, and by the midcentury a School of Inter-American Studies had been formed.

During the last two decades, the University of Florida's commitment to international studies has expanded rapidly. This expansion has resulted in the creation of a Center for Latin American Studies, a Center for African Studies, a Center for Tropical Agriculture, a program in International Relations, and an English Language Institute for speakers of other languages. Programs in Asian Studies, Soviet and East European Studies, and West European Studies

have been added to the undergraduate curriculum. The University of Florida has participated in programs of assistance and development in many major areas of the world: Africa, South America, Central America, and Southeast Asia. There has also been a corresponding increase in the number of faculty members involved in teaching and in research within the field of international studies.

The expansion of efforts in these directions represents a conviction on the part of the University that today's students must be aware, in more than a superficial way, of developments and trends outside our national boundaries if they are to live in a world of peace and harmony. International education is essential for the citizenry and leaders of the twenty-first century—the students of today.

Latin American Studies

The Center for Latin American Studies is responsible for directing and coordinating graduate training, research, and other academic activities related to the Latin American area. All students who meet the equivalent of a Master of Arts minor in Latin American Studies are eligible for inclusion in the Latin American Studies Program. Though requirements for this minor vary with individual departments, normally they consist of a minimum of 15 credits of Latin American language or area courses, or 9 credits of Latin American area courses and a reading knowledge of a Latin American language which is acceptable to the department in which the major is taken.

Master of Arts With Major in Latin American Studies.—This is an interdisciplinary area degree offered directly by the Center. Requirements are: (a) a major of 21 credits consisting primarily of Latin American language or area courses in one department, which may be agricultural economics, anthropology, economics, Romance languages (Spanish and Portuguese), geography, history, political science, and sociology; (b) 18 credits of Latin American language or area courses in at least two other departments; (c) a thesis on a Latin American topic for which up to 9 credits are given through registration in LA 699; (d) a reading, writing, and speaking knowledge of a Latin American language. The M.A. in Latin American Studies is intended primarily as a terminal degree for persons who, initially in their graduate program, are not aiming at a teaching career in traditional academic departments but who require a broad knowledge of Latin American cultures and appropriate language competence for their career objectives. It is so structured, however, that students may move directly from it into departmental Ph.D. programs without interrupting their academic progress.

Master's Degree with Certificate in Latin American Studies.—Through agreement with the Center, the departments named in the preceding paragraph permit a Latin American concentration in the major and minor fields. A Certificate in Latin American Studies may be awarded to students who complete the master's program in one of the participating departments and meet the following requirements: (a) 30 credits in the major department;

(b) a 9-credit minor in another department; (c) a thesis on a Latin American topic, for which 9 credits are given; (d) a reading knowledge of a Latin American language.

A Certificate may also be awarded to those students in a department permitting the master's degree without thesis who meet the following requirements: (a) departmental requirements for the major and minor; (b) 18 hours of Latin American content courses divided between at least two disciplines; (c) 54 credits of graduate course work; (d) a reading knowledge of a Latin American language. In choosing area courses, the student should work closely with the graduate coordinator of the Center for Latin American Studies. Only those courses specifically approved by the coordinator will be counted toward the required 18 hours of Latin American concentration.

THE PH.D. DEGREE.—The Center does not offer an interdisciplinary Latin American area degree at the doctoral level. Through agreement with participating departments, however, it does provide a Certificate in Latin American Studies which is awarded in conjunction with Ph.D. degrees in agricultural economics, anthropology, economics, education, geography, history, political science, sociology, and Spanish. Requirements for the certificate are: (a) Latin American concentration within the major department; (b) an area minor of at least 30 credits consisting principally, if not exclusively, of Latin American language and area courses in two or more departments outside the major and including at least 5 credits of LA 640, Latin American Area Seminar; (c) a dissertation on a Latin American subject; (d) a reading, speaking, and writing knowledge of one Latin American language and a reading knowledge of another; (e) residence in Latin America normally of at least six months' duration and devoted primarily to dissertation research.

GRADUATE FELLOWSHIPS AND ASSISTANTSHIPS.—NDEA Title VI Latin American Language and Area Fellowships, NDEA Title IV Fellowships (in agricultural economics, anthropology, history, political science, sociology, and Spanish), and University fellowships and assistantships are available on a competitive basis to students in the degree programs described above.

RESEARCH.—The Center supports or participates in a number of interdisciplinary research programs which, in addition to their primary objectives, provide opportunities for training and financial support of graduate students.

LIBRARY RESOURCES.—The several libraries on the campus of the University of Florida have Latin American holdings totaling over 110,000 volumes as well as important manuscript materials in the original, in transcription, and on microfilm. In terms of subject matter, holdings are strongest in history and the social sciences but increasing attention is being given to the environmental sciences and to literature. In terms of region, they are strongest in the Caribbean and circum-Caribbean but Brazilian materials are being augmented rapidly.

OTHER ACTIVITIES.—The Center sponsors conferences on Latin American topics and problems; supports publication of scholarly books, monographs,

and papers; and cooperates with other University units in organizing and conducting developmental programs in Latin America.

Inquiries about the various programs and activities of the Center should be addressed to: The Director, Center for Latin American Studies, Graduate and International Studies Building, University of Florida, Gainesville, Florida 32601.

African Studies Program

The African Studies Program, established with financial assistance under Title VI of the National Defense Education Act, is responsible for the direction and coordination of interdisciplinary instructional and research activities related to Africa, south of the Sahara. It cooperates with departments in administering and staffing a coordinated Certificate Program in African Studies. This program provides a broad foundation for students preparing for teaching or other professional careers in which a knowledge of African affairs is essential.

Graduate Degree Programs.—The African Studies Center does not offer interdisciplinary graduate degrees. With the cooperation of its participating departments, it offers a Certificate in African Studies in conjunction with the M.A. and Ph.D. degree.

Requirements for the Certificate in African Studies with the Master of Arts degree are: (a) at least 24 credits of course work in a departmental major; (b) 12 credits of course work in at least two other departments; (c) a thesis on an African topic; (d) two quarters of Swahili.

Requirements for the Certificate in African Studies with the doctoral degree are: (a) the doctoral requirements of the major department; (b) 27 credits of African language or area course work in two or more departments outside the major; (c) 5 credits in an area seminar; (d) a dissertation on an African topic based on field work in Africa; (e) knowledge of a language appropriate to the area of specialization.

Research.—The Center supports or participates in a number of interdisciplinary research programs which, in addition to their primary objectives, provide opportunities for training and financial support of graduate students.

Library Resources.—The Center has cooperated with the University libraries in the acquisition of African works. The African collection consists of approximately 12,000 volumes and over 400 serials related to Africa, south of the Sahara.

Inquiries about the various programs and activities of the Center should be addressed to: The Director, Center for African Studies, Graduate and International Studies Building, University of Florida, Gainesville, Florida 32601.

English Language Institute

A noncredit, nondegree program in English as a second language is available to foreign students with some knowledge of the language who wish to

increase their competence. The program, which may be taken any of the quarters of the academic year, emphasizes the oral and written skills needed by students from abroad who plan to attend a university in the United States. Further information is available from The Director, English Language Institute, Anderson Hall, University of Florida, Gainesville, Florida 32601.

Center for Tropical Agriculture

The Center for Tropical Agriculture, within the Institute of Food and Agricultural Sciences, seeks to stimulate interest in research and curriculum related to the tropical environment and its development.

Graduate Program.—An interdisciplinary minor in tropical agriculture may be planned at both the master's and doctoral levels by students majoring in agriculture, forestry, and other fields where knowledge of the tropics is relevant. The minor may include courses treating characteristics of the tropics: its soils, water, vegetation, climate, agricultural production, and the language and culture of tropical countries.

Research.—The Center provides research grants to faculty members and their graduate students and assists in the coordination of interdisciplinary research funded elsewhere. Development assistance contracts in agriculture and related fields frequently have research components.

Student Support.—Students within the College of Agriculture and the School of Forestry pursuing a minor in tropical agriculture are eligible for assistantships awarded by the Center through academic departments.

Other Activities.—The Center seeks a broad dissemination of knowledge about tropical agriculture through the sponsoring of conferences and seminars featuring leading authorities on the tropics, publication of books, monographs, and proceedings, and through acquisition of materials for the library and the data bank.

Organization for Tropical Studies

The Organization for Tropical Studies (OTS) is a consortium of major educational and research institutions in the United States and abroad, created to promote understanding of tropical environments and their inteliigent use by man. The University of Florida is a charter member. Graduate field courses in Central America are coordinated from the regional office in Costa Rica. Courses with varying content are offered in the agricultural sciences, earth sciences, forestry, geography, marine science, meteorology, and terrestrial biology during the winter, spring, and summer terms. Additional courses are being planned. Students are selected on a competitive basis from universities throughout the country. OTS provides round-trip transportation and maintenance in the field. A University of Florida graduate student may register for 12 credits in an appropriate departmental course cross-listed with OTS, such as ZY 605 or GPY 690. The University of Florida does not require tuition for

OTS courses. OTS offers pilot-study research grants to junior faculty and graduate students who have had limited tropical experience. Further information can be obtained from the OTS campus office located in the Center for Tropical Agriculture.

International Relations

Specialization in international relations leading to the M.A. and Ph.D. degrees is offered in programs through the Department of Political Science. In addition to the M.A. and Ph.D. with a major in political science which may emphasize international relations, the University offers an M.A. and Ph.D. with a major in international relations. For the M.A. the requirements are the same as for the M.A. in political science. For the Ph.D. the student has the option of offering either 1) four fields of political science and a single or composite minor, or 2) three fields of political science (plus two graduate courses in a fourth field) and two minor fields or a composite minor.

Division of Biological Sciences

The Division of Biological Sciences is organized within the College of Arts and Sciences to provide coordination in the biological sciences. The Division, with a staff from many disciplines, has organized faculties in cellular and molecular biology, genetics, developmental biology, parasitology, marine biology, radiation biology, and ecology. Each faculty is responsible for developing and supervising a core program in its special area. In addition to the cross-departmental programs, the Division serves to coordinate biological science wherever it exists in the University. The Departments of Zoology, Botany, Microbiology, Biochemistry, and Biological Sciences are the units composing the Division of Biological Sciences.

State Centers for Graduate Education in Engineering

Recognizing its responsibilities to the industries, engineers, and residents of Florida, the College of Engineering has established graduate engineering education centers where qualified personnel may enroll in courses leading to the master's degree. For admission to any of the graduate programs, the prospective student must file an application with the Graduate School as outlined in the *Admissions Section* of this *Catalog*. Off-campus centers are presently located at Eglin Air Force Base and Panama City.

For additional information, visit the nearest local center, or write to the Dean, College of Engineering, University of Florida, Gainesville, Florida 32601.

Genesys

GENESYS is an acronym for Graduate Engineering Education System. It consists of a closed-circuit television system, provided with a talk-back feature for student participation, regardless of location. There are both north-

bound and southbound channels connecting the Gainesville campus with satellite campuses at Daytona Beach, Orlando, Port Canaveral, West Palm Beach, and Florida Atlantic University at Boca Raton. Full-scale courses are offered and lectures may originate and be transmitted from studios located at any of these sites. Although primarily designed to meet the need of engineers in industry who cannot attend courses in Gainesville, graduate students pursuing advanced degrees in residence in Gainesville enroll in many of these courses. A detailed brochure on this system and its offerings may be obtained by writing the Dean of the College of Engineering.

Traveling Scholar Program

The State University System affords, under the Traveling Scholar Program, an opportunity for graduate students to take course work or conduct research activities at any of the universities in the State System. The course work taken under the auspices of the Traveling Scholar Program at another university in the System will apply for graduate degree credit at the student's home campus. The deans of the graduate schools of the State universities are the coordinators of the Program. For details regarding the Program and for approval to participate in it, students must apply to the dean of the graduate school on their home campus.

Public Administration

Graduate work is offered leading to various fields of public employment. Two training sequences are outlined here:

Management Sequence.—Adviser for the major field is in the Department of Political Science. Training in this area leads to positions in city manager government and meets state and federal civil service requirements. The major will be a concentration of public administration courses within the field of political science. A minor or minors may be taken in economics (concentration in public finance), accounting, or other areas.

Governmental Planning Sequence.—Adviser is in the Department of Political Science. Training in this area is offered leading to positions in local, state, and federal government planning agencies. The curriculum consists of seminars in planning, public administration, and public law and recommended courses in statistics, economics, sociology, geography, or agricultural economics. Supervised summer internships in selected planning agencies in Florida are arranged by the department as an integral part of the training program.

All sequences will include 45 credits of work and a thesis. The major is 18 to 27 credits and the minor is 8 to 18 credits, at least 8 of which must be in one field. The thesis normally requires 9 credits of research.

Urban Problems

A comprehensive curriculum concentrating on urban problems, leading to the Ph.D. degree, is offered through the Department of Political Science. A

comprehensive curriculum concentrating on urban problems, leading to the M.A. and Ph.D. degrees, is offered through the Department of Political Science. The program includes work in two fields in political science for the M.A. degree and in at least three fields in political science for the Ph.D. degree. A composite minor is specified for this curriculum and may include both substantive and methodological courses in urban-related areas of the other social sciences as well as fields such as statistics, systems engineering, and architecture. All other requirements, such as the core courses in methodology and the foreign language, remain the same as those for the regular M.A. and Ph.D. with a major in political science.

Master's Degrees for Junior College Teachers of Technology

Programs are offered cooperatively between the College of Education and the Colleges of Agriculture, Architecture and Fine Arts (Departments of Architecture and of Building Construction), Business Administration, Engineering, Health Related Professions, and Nursing. Their intent is to supply competent teachers for the many two-year technology programs being offered both in this and other states.

Normally, a person can complete this degree program in one calendar year if he has a prior degree in one of the fields listed or, if in an engineering field, has a working knowledge of calculus and college-level physics.

Admission Requirements.—Applicants must meet the admission requirements of the Graduate School and the College of Education. Generally speaking, applicants must have a baccalaureate degree from an approved college or university and must have a grade point average of at least 2.75 on a 4.0 system during their junior and senior years. The Aptitude Test of the Graduate Record Examination is also used as a basis for selection.

Curriculum.—The curriculum is a non-thesis program with a minimum requirement of 50 credits. The student must satisfy the master's degree requirements of the college from which he expects to receive the degree. The general pattern of all programs includes from 16 to 32 credits of education and 16 to 32 credits of work in the technical specialty. An individual's program will depend upon his previous background and experience.

Ford Foundation Three-year Master's Program

Originally supported by a grant from the Ford Foundation, a three-year master's degree program in the Graduate School is now conducted by the University of Florida. The program begins with the junior year and normally continues through the first year of graduate study. Students who maintain satisfactory progress are awarded a fellowship or assistantship for the third or final year, and receive both the bachelor's and master's degrees. Program fellowships of $300 per month and cancellation of non-Florida fees (but not registration fees) for the first year of graduate study are available. For further details, contact the Graduate School office.

Research Program through the Oak Ridge Associated Universities

The University of Florida is one of the sponsors of the Oak Ridge Associated Universities, Incorporated, located at Oak Ridge, Tennessee, a nonprofit educational and research corporation of 41 Southern colleges and universities. Through this sponsorship our graduate research program has at its disposal all the facilities of the Oak Ridge National Laboratory, the Medical and Special Training Divisions of the Oak Ridge Associated Universities, the Atomic Energy Commission—University of Tennessee Agricultural Research Laboratory, and the research staffs of these laboratories. When a candidate has completed one year (two for the Ph.D.) of his resident work, it is possible, by special arrangement, for him to go to Oak Ridge to work toward completion of his research problem and the preparation of his thesis. In addition, it is possible for the staff members of this University to go to Oak Ridge for varying periods, usually not less than three months, for advanced study in their particular field. Both staff and students are kept abreast of the most modern and up-to-date developments in atomic and nuclear research in progress at the Oak Ridge laboratories.

The students who go to Oak Ridge hold Oak Ridge Graduate Fellowships, which have varying stipends determined by the number of their dependents and their level of work. Staff members may work at Oak Ridge on stipends commensurate with their present salaries.

A copy of the bulletin and announcement of the Graduate Training Program of the Oak Ridge Associated Universities is available in the Office of the Graduate School. Bulletins may also be obtained by writing to the Chairman of the University Relations Division of the Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, Tennessee 37831. Interested persons should ask for assistance from Dr. Billy G. Dunavant, Director of the University's Nuclear Sciences Division, who serves as the Oak Ridge Associated Universities Counselor at the University of Florida.

All arrangements for these fellowships will be made between the Dean of the Graduate School and the Oak Ridge Associated Universities.

SPECIAL FACILITIES

University of Florida Libraries

The library system consists of two central units, Library West and Library East, and branch libraries in the College of Architecture and Fine Arts, Education, Engineering, Law, the Institute of Food and Agricultural Sciences, the J. Hillis Miller Health Center, the Department of Chemistry, and the P. K. Yonge Laboratory School. In addition, reading room facilities have been provided for Journalism and Communications, Health and Physical Education, Music, and the dormitory areas.

The holdings of the libraries number over 1,350,000 cataloged volumes and a large number of uncataloged documents and newspapers.

Library West, opened in 1967, houses 600,000 books, has a seating capacity of 910, and contains 120 conference rooms and studies.

The main reference and bibliography collection, which includes the basic bibliographies, abstracting and indexing services, and catalogs of other libraries, is located in the first floor of Library West. Another basic collection of reference materials is located on the second floor of Library East. In both places librarians are available for consultation and assistance.

Among the special collections in Library West are the Rare Book Collection, The Dance-Music-Theater Archives, the P. K. Yonge Library of Florida History, the Marjorie Kinnan Rawlings Collection, which consists of manuscripts, typescripts, and memorabilia of one of America's distinguished novelists, and the Collection of Creative Writing, which includes work sheets, manuscripts, and other literary papers of significant contemporary American and British authors. The Libraries' outstanding Latin American Collection, which has been steadily strengthened in recent years, especially in the areas of West Indian and Caribbean materials, is housed in Library East.

Florida State Museum

The Florida State Museum was created by an act of the Legislature in 1917 as a department of the University of Florida. Through its affiliation with the University it carries dual responsibility as the State Museum of Florida and as the University Museum.

The Museum operates as a center of research in anthropology and natural history. Its accessory functions as an educational arm of the University are carried forward through interpretive displays and scientific publications. Under the administrative control of the director are the three departments of the Museum: Natural Sciences, staffed by scientists and technicians concerned with the study and expansion of the research collections of animals; Social Sciences, whose staff members are concerned with the study of historic and prehistoric cultures; Interpretation, staffed by specialists in the interpretation of knowledge through museum exhibit techniques. Members of the scientific and educational staff of the Museum hold dual appointments in appropriate teaching departments. Through these appointments they participate in both the undergraduate and graduate teaching programs.

Graduate assistantships are available in the Museum in areas emphasized in its research programs.

The Museum is located at the corner of Museum Road and Newell Drive in a modern facility completed in 1970. The public halls are open from nine-thirty until five o'clock. The Museum is closed on Christmas Day. There is no admission charge.

The research collections are under the care of curators who encourage the scientific study of the Museum's holdings. Materials are constantly being added to the collection both through gifts from friends and as a result of research activities of the Museum staff. The archaeological collections are

noteworthy. There are extensive study collections of birds, mammals, mollusks, reptiles, amphibians, fish, and invertebrate and vertebrate fossils. Opportunities are provided for students, staff, and visiting scientists to use the collections. Research and field work are presently sponsored in the archaeological, paleontological, and zoological fields. Students interested in these specialties should make application to the appropriate teaching department.

University Center of the Arts

The University Center of the Arts serves students, faculty, and the general public by presenting exhibitions and performances of the best works in the visual and performing arts.

University Gallery

The University Gallery is an integral part of the Architecture and Fine Arts complex. The Gallery is located on the campus facing S.W. 13th Street (or U. S. 441). An atrium and a reflecting pool are two pleasing features of the Gallery's distinctive architectural style. The Gallery, with 3000 square feet of display space, is completely modern, air-conditioned, and maintains a varied exhibition schedule of the visual arts during the year. The contents of exhibitions displayed in the University Gallery range from the creations of traditional masters to the latest and most experimental works by the modern avant garde. The minor arts of yesterday and today, along with the creations of oriental and primitive cultures, form topics for scheduled exhibitions. The Gallery originates one or two of the major exhibitions during the year. Each exhibition shows for approximately a month, and the Gallery's hours are from 9 A.M. to 5 P.M daily except Sunday, when they are from 1 P.M. to 5 P.M. The Gallery is closed Saturdays, holidays, and during the month of September.

Teaching Gallery

The Teaching Gallery of the Department of Art is located adjacent to the department's office area, on the third floor of the new Classroom Building in the College of Architecture and Fine Arts complex. As a direct and physical adjunct to the Art Department's teaching program, this Gallery displays smaller traveling exhibitions of merit, as well as one-man shows by faculty artists and student exhibitions. The Gallery is open Monday through Friday from 9 A.M. to noon and from 1:30 P.M. to 5 P.M. It is closed Saturdays and Sundays.

Computing Center

The Computing Center of the University provides the services of IBM System/360 Model 65 and 1401 electronic computers, a 563 Calcomp Plotter, and other subsidiary equipment.

The principal functions of the center are:

1. To aid research by furnishing consulting services and computing support for the faculty, staff, graduate students, and others.
2. To provide computing support for undergraduate and graduate classes.
3. To maintain a library of computer programs for the benefit of users.
4. To carry on investigations in the theory and application of numerical analysis.
5. To conduct research under contract or other arrangements for university, federal, state, and other government agencies, as well as for foundations and individuals.
6. To assist in coordinating and developing University research programs in which the computer may be involved.
7. To provide computation facilities for other educational and research units of the University.
8. To provide instruction in the various computer programming languages and in techniques for submitting and improving programs run on the computer.

The Computing Center is primarily a research unit, though members of the staff may teach courses in other departments. Thesis work may be carried on in the Center.

University of Florida Press

The purpose of the University Press is to encourage, seek out, and publish original and scholarly manuscripts which will aid in developing the University as a recognized center of research and scholarship.

In addition to its broad range of state, regional, and Latin American titles, the Press publishes books of general interest and five separate series in Floridiana, geronotology, humanities, Latin American studies, and social sciences. It is also the publisher of *The Handbook of Latin American Studies,* sponsored by the Library of Congress.

The Press Board of Managers, including the director and fourteen faculty experts appointed by the President of the University, determines policies of publication relating to the acceptance or rejection of manuscripts and the issuance of author contracts. Each year the board examines numerous manuscripts submitted not only by the University faculty but by authors from all over the United States, Europe, and Latin America.

The Press is a member of the Association of American University Presses and of the Association of American Publishers, Inc.

Students and members of the faculty and staff are cordially invited to visit the Press offices at 15 N.W. 15th Street, adjacent to the campus.

University of Florida Monograph Series

The Graduate School sponsors two monograph series devoted to the publication of research primarily by present and former members of the scholarly

community of the University. The *Social Sciences Monographs* are published four times each year with subjects drawn from anthropology, economics, history, political science, sociology, education, geography, law, and psychology. The *Humanities Monographs* are published three times each year with subjects drawn from art, language and literature, music, philosophy, and religion.

ORGANIZED RESEARCH

THE DIVISION OF SPONSORED RESEARCH has two general functions: (1) the administration and promotion of the Sponsored Research Program and (2) the support of the total research program of the University in a manner which produces maximum benefit to the University and the greatest service to the State of Florida. All proposals for the sponsorship of research, grants-in-aid, or training grants must receive the approval of the Director of Research. Subsequent negotiations with potential contracting agencies or sponsors of research projects are carried on under the Director's supervision.

The activities of the Division of Sponsored Research are intended to stimulate growth and to assist in expanding a balanced research program throughout the University. These activities are intimately related to the support of the graduate program. They are also intended to relieve principal investigators and departments of many of the detailed administrative and reporting duties connected with some sponsored research. The duties and responsibilities of the Division, of course, do not infringe upon the prerogative of the principal investigator to seek sponsors for his own projects nor upon the responsibility of the researcher for the scientific integrity of a project. In direct contacts between a principal investigator and a potential sponsor, however, prior clearance should be obtained from the Division to insure a uniformity in contract requirements and to avoid duplication of negotiations with the same sponsor.

The Division of Sponsored Research is administratively responsible to the Vice President for Academic Affairs. Policies and procedures for the operation of the Division are developed by a Board of Directors working with the Director of Research within the general framework of the administration, policies, and procedures of the University. The Research Council serves as adviser on scientific matters. The Dean of the Graduate School and the Graduate Council serve as advisers on matters relating to the graduate program.

THE AGRICULTURAL EXPERIMENTAL STATIONS are responsible for research leading to the improvement of all phases of Florida's widely varied agricultural production, processing, and marketing. The stations are administered from the University of Florida campus by the Dean for Research and include main station departments as well as branch stations and field laboratories operating as an integral administrative unit. As a statewide agency having agricultural research as its primary objective, the stations cooperate closely with numerous Florida agricultural agencies and organizations.

Many members of the research staff of the Agricultural Experiment Stations are also members of the faculty of the College of Agriculture as are some in the Agricultural Extension Service and the Center for Tropical Agriculture. These three agricultural units of the University of Florida Institute of Food and Agricultural Sciences work cooperatively in many areas under the administration of the Provost for Agriculture.

Funds for graduate assistants are made available to encourage graduate training and professional scientific improvement.

Research at the main station is conducted within 18 departments—Agricultural Economics, Agricultural Engineering, Agronomy, Animal Science, Bacteriology, Botany, Dairy Science, Entomology, Food Science, Forestry, Fruit Crops, Ornamental Horticulture, Plant Pathology, Poultry Science, Soils, Statistics, Vegetable Crops, and Veterinary Science. In addition to the above, the main station has four units vital to its research programs; namely, Editorial, Library, Field Services, and Business Service.

The branch stations and field laboratories, and their locations, are as follows: Central Florida Station, Sanford; Citrus Station, Lake Alfred; Everglades Station, Belle Glade; Gulf Coast Station, Bradenton; North Florida Station, Quincy; Range Cattle Station, Ona; Sub-Tropical Station, Homestead; Suwannee Valley Station, Live Oak; West Florida Station, Jay; Indian River Field Laboratory, Fort Pierce; Plantation Field Laboratory, Fort Lauderdale; South Florida Field Laboratory, Immokalee; Potato Investigations Laboratory, Hastings; Big Bend Horticultural Laboratory, Monticello; Strawberry and Vegetable Field Laboratory, Plant City; Watermelon and Grape Investigations Laboratory, Leesburg; West Florida Dairy Unit, Chipley; and Marianna Unit, Marianna.

The Florida Agricultural Experiment Station is cooperating with the Brooksville Beef Cattle Research Station, Brooksville, a USDA field laboratory, in its beef cattle and pasture production and management programs and with the United States Weather Bureau, Lakeland, in the Federal Frost Warning Service for fruit and vegetable producers and shippers.

The Florida Engineering and Industrial Experiment Station developed from early research activities of the engineering faculty and was officially established in 1941 by the Legislature as an integral part of the College of Engineering. Its mandate is "to organize and promote the prosecution of research projects of engineering and related sciences, with special reference to such of these problems as are important to the industries of Florida."

The College and the Station are inextricably intertwined—the two activities cannot be separated functionally; they comprise the two arms of the whole engineering body. This is particularly true at the graduate level. In many instances a program initiated primarily as a research activity has developed into a full-fledged academic department of the College, demonstrating the close interlocking relationship of the research and teaching functions.

Since the fall term of 1967, seven departments of the College of Engineering and the Experiment Station have moved into some 310,000 sq. ft. in

seven modern new buildings and one remodeled building. These improvements, including equipment, have raised the value of the physical plant of the College to over $13 million.

The laboratories, staff, and facilities of other divisions of the University are also available to the Station research faculty through many outstanding interdisciplinary programs, which provide Station support of graduate students in the physical sciences such as physics and chemistry, as well as in engineering. With the close relationship that exists between teaching and research, students are exposed to many engineering and industrial problems normally not encompassed in a college program.

The Station receives only a small portion of its operating revenue from the state. The major support of its research activities is derived from contracts with government agencies, foundations, and industrial organizations. Large and small manufacturers avail themselves of the finest engineering research laboratories in the Southeast. The Station has superior facilities and staff in such fields as microelectronics and integrated circuits, power systems, metallurgy, ceramics, coastal engineering, soil mechanics, transport phenomena and fluid dynamics, energy conversion, air and water pollution control, electrochemistry, fast neutron physics, nuclear rocket propulsion, dynamics and vibrations, communications, kinetics, ionics, gaseous electronics and plasmas, computer and information science, and systems analysis, to name a few.

THE BUREAU OF RESEARCH is one of the activities of the College of Architecture and Fine Arts. It fosters and encourages research in all areas of the building arts and fine arts. It also provides an opportunity for graduate students and faculty members to engage in research and cooperate effectively in research with other departments and institutions.

THE BUREAU OF ECONOMIC AND BUSINESS RESEARCH is the research division of the College of Business Administration. A part of the Bureau's work is designed to further understanding of the economy of Florida and the Southeast. Economic, business, and related research supported by grant and contract funds is undertaken in subject areas of interest to the faculty. Graduate students are involved also in these projects.

The Bureau publishes two monthly periodicals: *Dimensions* and *Economic Leaflets*. Through these publications and through monographs, the Bureau disseminates the results of research and statistical studies of personal income, population, construction, retail sales, employment, and the activities of commercial banks and savings and loan associations.

THE PUBLIC ADMINISTRATION CLEARING SERVICE is a research and service adjunct of the Department of Political Science in the College of Arts and Sciences. It carries on a continuous program of research in public administration, political behavior, and public policy in Florida, publishes research studies and surveys of administrative and political problems in both scientific and popular monograph form, and publishes a *Civic Information Series*

annually for assistance to citizen groups in their study of current issues in the state.

The Institute of International Relations is a research agency administered through the Department of Political Science to conduct studies in international relations.

The Research Division of the College of Journalism and Communications conducts research in the news media, broadcasting, advertising, and public opinion.

The Urban Studies Bureau is a university-wide organization administered through the office of the Vice President for Academic Affairs. Its function is to facilitate and encourage the development of interdisciplinary research in urban areas, the development of curriculum and training programs in urban studies, and the establishment of a liaison between the University and urban centers.

The Florida Water Resources Research Center was established in 1964 as the result of the passage of P.L. 88-379—The Water Resources Research Act of 1964—"to stimulate, sponsor, provide for, and supplement present programs for conduct of research, investigation, experiments, and the training of scientists in the fields of water and of resources which affect water." The Center has a small administrative staff and the funds available to it are used largely in water research projects. It is under the general policy guidance of a committee composed of the Vice President for Academic Affairs, the deans of the colleges of Arts and Sciences, Engineering, and Law, the Dean for Research of the Institute of Food and Agricultural Sciences, and the Director of the Division of Sponsored Research.

The Health Systems Research Division is an interdisciplinary activity organized within the office of the Provost, J. Hillis Miller Health Center. Its function is to design and conduct systems research aimed toward improvements in the effectiveness and efficiency of the delivery of all types of health services and the development of methods for the optimal allocation of health resources. Research projects are carried out in and for the Shands Teaching Hospital and Clinics and the various colleges of the Health Center by faculty and graduate students from a number of academic disciplines, especially the Department of Industrial and Systems Engineering and the graduate program in Health and Hospital Administration. In addition to research efforts for health units within the University of Florida supported by the state or by research grants from outside sources, projects are conducted on a contract basis for health organizations and agencies outside the University.

Interdisciplinary Research Centers

The University of Florida is developing a number of interdisciplinary research centers whose primary responsibility will be to increase knowledge in specific fields of study and to apply the knowledge so gained to solve crucial

problems that society now faces. Among the centers that are already established or whose development is in an advanced stage of planning are the following:

THE CENTER FOR AERONOMY AND OTHER ATMOSPHERIC SCIENCES (ICAAS) is a community of scholars drawn from many disciplines represented at the University of Florida. Each scholar has an established professional knowledge and research capability in the atmospheric sciences or in physical, biological, or societal disciplines that relate closely to our atmospheric environment. As an interdisciplinary center, ICAAS promotes pure and applied research in the atmospheric sciences and provides machinery for translating research into forms relevant to societal needs. The aeronomical research of the Center deals with physical, chemical, and electrical processes in the upper atmosphere, e.g. the stratospheric, ionospheric and thermospheric regions of the earth. Other activities include a diverse range of tropospheric and micrometeorological research as well as biological, ecological, and technological research related to the quality of the air we breathe. These activities are dispersed widely in the Colleges of Arts and Sciences, Engineering, Medicine, Law, and Agriculture. The primary function of ICAAS is to provide coordination, direction, and focus to strengthen existing programs and to expand them in directions that will help mitigate the socio-technical problems arising from the degradation of our atmospheric environment. ICAAS will also help the training of able students at the undergraduate, graduate, and postdoctoral levels in various pure and applied aspects of the atmospheric sciences. For information write the Director, Center for Aeronomy and other Atmospheric Sciences, 221 Space Sciences Research Building, University of Florida.

THE CENTER FOR AQUATIC SCIENCES is responsible for intensive development and coordination of University-wide activities in the freshwater, estuarine, and coastal marine sciences. With major emphasis on Florida and contiguous waters, the Center provides leadership for interdisciplinary programs of benefit to the State. The broad spectrum of curricula, facilities, and faculty at the University allows students great latitude in developing their specific interests in the aquatic sciences. Undergraduate and graduate support is provided by the Center, enabling students in cooperating departments to investigate problems related to Florida's aquatic resources. The University's Marine Institute is situated at Marineland, and field stations are also located nearby at Cedar Key and Welaka. Interested persons should contact the Director, Center for Aquatic Sciences, the Graduate School, University of Florida, Gainesville, Florida 32601.

THE CENTER FOR INFORMATICS RESEARCH is responsible for directing and coordinating advanced studies and research activities in computers, information systems, software engineering, and their implications for various disciplines. As an interdisciplinary center, it creates a stimulating environment for basic and applied research to seek new insights in and optimal solutions to engineering, physical, biological, medical, management, and social problems by

uncovering new patterns in massive amount of data. The Center staff seeks to solve problems in various disciplines by using modern computing machines, recent communication sciences, and the latest information technology. The research laboratories are equipped with an IBM 7094-II computer system, a Graphic-I system, a FIDAC (Film-input-to-digital automatic computer) system, and a PDP-5 computer. The Center sponsors the International Symposia on Computer and Informational Science (COINS Symposia), cooperates with other University units in organizing and conducting conferences, seminars, short courses, and developmental programs in informatics, and supports publication of scholarly books, monograph series, and an international journal. Inquiries about the various programs and activities of the Center should be addressed to: The Director, Center for Informatics Research, 339 Larsen Hall, University of Florida, Gainesville, Florida 32601.

STUDENT SERVICES

THE OFFICE OF THE ADVISER TO FOREIGN STUDENTS is the center for services performed in behalf of foreign students from their initial inquiries until their return home. The office coordinates with other university agencies and is charged with responsibilities involving admissions, reception, orientation, housing, finances, health, immigration, academic counseling, petitions, practical training, employment, embassy and foundation reports, correspondence, legal problems, life counseling, and community relations. The adviser also serves as Fulbright Program Adviser and assists foreign faculty members.

THE UNIVERSITY CAREER PLANNING AND PLACEMENT CENTER functions as the central placement agency for the campus with services available to all students and alumni of the University; and it works in conjunction with those schools and colleges that give direct employment assistance to their graduates.

In cooperation with educational and administrative units, counseling and testing services, and other related functions, the placement center makes its contribution to the development of the whole individual. Its primary aim is to offer assistance to students, from the time they enter school until they graduate, in the development of vocational goals and the attainment of their first career position. Assistance is also offered to alumni who have attended graduate school elsewhere, who are returning to civilian life from the military, or who desire to make changes in employment.

Functions include: (1) serving as liaison between students and business, industrial, governmental, and educational organizations that seek college-trained personnel for permanent employment; (2) establishing and maintaining records on registrants, employment opportunities, and placement results; (3) conducting studies on the employment outlook, salary trends, progress of graduates in the working world, and related matters; (4) assisting students who leave school before graduation or who want summer jobs that relate to their

fields of study and employment goals; (5) serving in a public relations capacity in dealing with employers and the public.

Specific services include career planning and guidance, counseling on the tools and techniques of the job search, arranging interviews between employers and students, providing personnel records and faculty ratings on students to employers, preparing and mailing lists of job opportunities to registrants, distributing recruitment booklets and materials, and administering tests for employers.

THE UNIVERSITY COUNSELING CENTER provides psychological services to the members of the student body and consultative services for University staff members who counsel students. It also provides a practicum for graduate students in the departments of Psychology and Counselor Education. It engages in institutional as well as basic research in the problems of counseling. Specific services include vocational, personal, marriage, and academic counseling. In these functions the University Counseling Center works closely with staff in the residence halls and with the academic advisers in the University College and upper-division colleges. The Center works with the University Mental Health Service on a referral basis and with the director of the early registration program in the orientation of prospective students to the University.

THE STUDENT HEALTH SERVICE provides medical care, health maintenance programs, and mental health consultation to all full-time students in the University. The student health fee is a part of the tuition fee. A student Health Insurance Policy which is designed to provide additional compensation for costs of hospitalization, referral services, and diagnostic procedures is available and highly recommended, but is not mandatory. Several immunization inoculations are required prior to registration. Applicants for admission to the University receive a form for medical history and physical examination. The history should be completed by the applicant before he goes to his physician for physical examination. The examination portion and the immunizations must be completed by a licensed doctor of medicine (M.D.) and the form mailed by the doctor to the Director, Student Health Service. This health record is then reviewed by a physician before the applicant is cleared for registration at the University. (For additional information see the *Undergraduate Catalog.*)

THE SPEECH AND HEARING CLINIC, Room 436, Arts and Sciences Building, offers services without charge to any University student who has a speech or hearing disorder. This assistance is available at any time during the year and therapy sessions are adjusted to individual schedules. The student is encouraged to visit the Clinic and to use this service.

THE GRADUATE SCHOOL EDITORIAL SERVICE aids in the preparation of the thesis or dissertation as one aspect of the mature and responsible scholarship expected of a candidate. The following policies and procedures apply to the Graduate School's editorial services for students:

1. The responsibility for acceptable English in a thesis or dissertation lies principally with the student and his Supervisory Committee.
2. The Graduate School staff acts in an advisory capacity. It informs the student concerning acceptable form, not content. The staff spot-checks each dissertation for format, proper footnote form, pagination, and general mechanics.
3. The Graduate School staff can advise a student concerning proper grammar, sentence structure, and correct word usage only to the extent of correcting a few pages.
4. If the student will bring his rough draft to the editorial office of the Graduate School, the staff will examine a limited portion and make recommendations concerning the form of the thesis or dissertation before it is put into final form.

Fields of Instruction

COLLEGES AND DEPARTMENTS

Agriculture

- Agricultural Economics
- Agronomy
- Animal Science
- Dairy Science
- Entomology and Nematology
- Food Science
- Fruit Crops
- Ornamental Horticulture
- Plant Pathology
- Poultry Science
- Soils
- Vegetable Crops
- Veterinary Science

Architecture and Fine Arts

- Architecture
- Art
- Building Construction
- Music

Arts and Sciences

- Anthropology
- Astronomy
- Biochemistry
- Botany
- Cellular and Molecular Biology
- Chemistry
- English
- Geography
- Geology
- Germanic and Slavic Languages and Literatures
- History
- Latin American Studies
- Linguistics
- Mathematics
- Microbiology
- Philosophy
- Physics
- Political Science
- Psychology
- Romance Languages and Literatures
- Sociology
- Speech
- Statistics
- Zoology

Business Administration

- Accounting
- Economics
- Finance and Insurance
- Health and Hospital Administration
- Management and Business Law
- Marketing
- Real Estate and Urban Land Studies

Education

- Counselor Education
- Educational Administration
- Elementary Education
- Foundations of Education
- Secondary Education
- Special Education
- Vocational, Technical, and Adult Education

Engineering

- Aerospace Engineering
- Agricultural Engineering
- Chemical Engineering
- Civil Engineering
- Coastal and Oceanographic Engineering
- Electrical Engineering
- Environmental Engineering Sciences
- Engineering Science and Mechanics
- Industrial and Systems Engineering
- Mechanical Engineering
- Metallurgical and Materials Engineering
- Nuclear Engineering Sciences

Forestry

HEALTH RELATED PROFESSIONS

- Clinical Psychology
- Communicative Disorders
- Health and Hospital Administration
- Rehabilitation Counseling

JOURNALISM AND COMMUNICATIONS

MEDICINE—Medical Sciences

- Immunology and Medical Microbiology
- Neuroscience
- Pathology
- Pharmacology
- Physiology
- Radiology

NURSING

PHARMACY

- Pharmaceutical Chemistry
- Pharmacognosy
- Pharmacy

PHYSICAL EDUCATION, HEALTH, AND RECREATION

COURSE ABBREVIATIONS

ADP	Animal Science—General
ADV	Advertising (*see* Journalism and Communications)
AE	Architecture
AGE	Agricultural Engineering
AL	Animal Science
APY	Anthropology
ART	Art
AS	Agricultural Economics
ASC	Arts and Sciences—General
ASE	Aerospace Engineering
ATG	Accounting
ATY	Astronomy
AY	Agronomy
BCH	Biochemistry
BCN	Building Construction
BLY	Cellular and Molecular Biology
BR	Broadcasting (*see* Journalism and Communications)
BS	Business Administration—General
BTY	Botany
CE	Civil Engineering
CHE	Chemical Engineering
COE	Coastal and Oceanographic Engineering
COM	Journalism and Communications
CY	Chemistry
DY	Dairy Science
ED	Education—General
EDA	Educational Administration
EDC	Counselor Education
EDE	Elementary Education
EDF	Foundations of Education
EDH	Special Education
EDS	Secondary Education
EDV	Vocational, Technical and Adult Education
EDX	Agricultural Education (*see* Vocational, Technical and Adult Education)
EE	Electrical Engineering
EGC	Engineering—General
EH	English
ENE	Environmental Engineering Sciences
ES	Economics
ESM	Engineering Science and Mechanics
EY	Entomology and Nematology
FC	Fruit Crops
FH	French (*See* Romance Languages and Literatures)
FI	Finance and Insurance
FLE	Romance Languages and Literatures
FS	Food Science
FY	Forestry
GN	Germanic and Slavic Languages and Literatures
GPY	Geography

GY	Geology
HA	Health and Hospital Administration
HRP	Health Related Professions—General
HY	History
ISE	Industrial and Systems Engineering
JM	Journalism (*See* Journalism and Communications)
LA	Latin American Studies
LIN	Linguistics
LN	Latin (*see* Romance Languages and Literatures)
LW	Law (*see* Health and Hospital Administration; Latin American Studies)
LY	Library Science
MCY	Microbiology
ME	Mechanical Engineering
MED	Medical Sciences — General; Immunology and Medical Microbiology; Neuroscience; Pathology; Pharmacology; Physiology; Radiology
MGT	Management and Business Law
MKG	Marketing
MS	Mathematics
MSC	Music
MTL	Metallurgical and Materials Engineering
NES	Nuclear Engineering Sciences
NSG	Nursing
OH	Ornamental Horticulture
PCL	Political Science
PCY	Pharmaceutical Chemistry
PE	Portuguese (*see* Romance Languages and Literatures)
PGY	Pharmacognosy
PHR	Physical Education, Health, and Recreation
PHY	Pharmacy
PPY	Philosophy
PR	Public Relations (*see* Journalism and Communications)
PS	Physics
PSY	Psychology
PT	Plant Pathology
PY	Poultry Science
RC	Rehabilitation Counseling
RE	Real Estate and Urban Land Studies
RSN	Russian (*see* Germanic and Slavic Languages and Literatures)
SCH	Speech
SH	Spanish (*see* Romance Languages and Literatures)
SI	Swahili (*see* Linguistics)
SLS	Soils
STA	Statistics
SY	Sociology
VC	Vegetable Crops
VY	Veterinary Science
ZY	Zoology

ACCOUNTING

GRADUATE FACULTY 1970-71

STONE, W. E., *Chairman;* BENNINGER, L. J.; CRUMBLEY, L. D.; DEINZER, H. T.; RAY, D. D.; THORNE, J. F.; WHITEHURST, F. D.; YU, S. C.

Graduate Coordinator: W. E. STONE

For admission to graduate-level courses, the student normally must have been admitted to the Graduate School and should have had undergraduate courses in fields pertinent to the graduate courses selected; or, where necessary, special arrangements may be made with the approval of the department chairman.

Though no graduate major may be completed without adequate course work on the 600 or higher level, certain undergraduate courses in accounting are available for graduate credit as a part of a candidate's major when specifically approved by the candidate's adviser.

Students preparing for the Ph.D. degree with an accounting major are required to undertake three quarters of teaching of elementary accounting. During each of these periods, the student will enroll for 3 credit hours of BS 698—SUPERVISED TEACHING. Grants-in-aid will be awarded for such teaching.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ATG 502—ACCOUNTING THEORY. 3 credits
ATG 503—COST ACCOUNTING THEORY AND APPLICATION. 4 credits
ATG 504—FEDERAL INCOME TAXATION OF BUSINESS ORGANIZATIONS. 3 credits
ATG 505—FEDERAL INCOME TAX PLANNING. 3 credits

GRADUATE COURSES

ATG 601—DEVELOPMENT OF THOUGHT IN ACCOUNTING THEORY. 5 credits
Inquiry into criteria for choice among income-determination and asset-valuation rules in the context of public reporting.

ATG 602—ACCOUNTING INFORMATION FOR EXTERNAL USERS. 5 credits
Generation of accounting data for non-management evaluation and control of the processes through which economic resources are administered.

ATG 603—SOCIAL AND ECONOMIC ACCOUNTING. 5 credits
Identical with ES 603. Social accounts and comparative economic accounting systems, with emphasis on national income accounting, the national balance sheet, sector accounts, and flow of funds analysis.

ATG 604—ACCOUNTING AND ANALYTICAL METHODS. 5 credits
Utilization of logic, including mathematics, in the formulation of alternative accounting valuation models and in the clarification of accounting concepts.

ATG 605—THE FEDERAL INCOME TAX: FUNCTIONAL ANALYSIS. 5 credits
Prerequisite: ATG 407. Critical analysis of federal income tax provisions especially as related to the use of income concepts. Major emphasis is on the business-tax component of the federal income tax system.

ATG 607—Accounting Theory as Related to Managerial Decision Making. 5 credits

Prerequisite: ATG 401. Theoretical framework of accounting related to decision-making processes of management.

ATG 608—Interdisciplinary Considerations in Accounting Theory Development. 5 credits

Developments in related disciplines, such as economics, law, and behavioral sciences, analyzed for their contribution to accounting thought.

ATG 630—Individual Work in Accounting. 1 to 5 credits

Prerequisites: Permission of department and approval of Director of Graduate Studies. Reading and research in areas of accounting as needed by individual graduate students. May be repeated with change of content up to a maximum of 10 credits.

ATG 699—Master's Research. 1 to 17 credits

AEROSPACE ENGINEERING

GRADUATE FACULTY 1970-71

Clarkson, M. H., *Chairman;* Anderson, R. C.; Fearn, R. L.; Green, A. E. S.; Hoover, J. W.; Keefer, D. R.; Kurzweg, U. H.; Leadon, B. M.; Milton, J. E.; Myers, O. E.; Sierakowski, R. L.; Williams, D. T.

Graduate Coordinator: M. H. Clarkson

General prerequisites are one year of engineering physics or its equivalent, mathematics through differential equations, and an adequate foundation in the general field of engineering, encompassing dynamics, fluid dynamics, thermodynamics, and strength of materials. In addition, permission of instructor is required for each course.

The following *Engineering Common Courses* are available for graduate major credit: EGC 541—Tensor Fields and Fluid Dynamics; EGC 601—Theory of Fluid Flow 1; EGC 602—Theory of Fluid Flow 2; EGC 603—Theory of Fluid Flow 3; EGC 604—Boundary Layer Theory; EGC 605—Theories of Turbulent Flows; EGC 611—High Speed Gas Dynamics 1; EGC 612—High Speed Gas Dynamics 2; EGC 613—High Speed Gas Dynamics 3; EGC 671—Introduction to Plasmas; EGC 672—Plasma Theory; EGC 675—Plasma Laboratory.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ASE 501—Stability and Control of Aircraft. 4 credits

ASE 541—Aerospace Structural Composites 1. 3 credits

ASE 570—Principles of Guidance and Control. 3 credits

GRADUATE COURSES

ASE 601—Advanced Plasma Topics. 3 credits

Selected topics with application to aeronautics and astronautics.

ASE 602—Probe Techniques for Plasma Diagnostics. 3 credits
Prerequisite: EGC 671. Basic theory of electric and magnetic probes for plasma diagnostics and its practical application to laboratory plasmas.

ASE 611—The Dynamics of Real Gases 1. 3 credits
Theoretical basis of high energy gas dynamics reviewed and applied to reacting ionizing and radiating flows.

ASE 612—The Dynamics of Real Gases 2. 3 credits
Continuation of ASE 611.

ASE 613—The Dynamics of Real Gases 3. 3 credits
Continuation of ASE 612.

ASE 631—Advanced Aerospace Structures 1. 3 credits
Steady state aeroelastic and structural problems. Flutter analysis. Transient loads, nonstationary and oscillating airfoil theory.

ASE 632—Advanced Aerospace Structures 2. 3 credits
Continuation of ASE 631.

ASE 633—Advanced Aerospace Structures 3. 3 credits
Continuation of ASE 632.

ASE 641—Aerospace Structural Composites 2. 3 credits
Prerequisites: ESM 634, ASE 541. Analysis of fibrous reinforced structural composites for aerospace applications.

ASE 650—Physiological Aspects of Atmospheric and Space Flight. 3 credits
Physiological and psychological factors influencing design considerations for manned aircraft and spacecraft.

ASE 661—Astronautical Mechanics 1. 3 credits
General laws of mechanics of particles and rigid bodies. Newtonian orbits; theory of gyroscopes. General transformation theory; Hamilton-Jacobi equations.

ASE 662—Astronautical Mechanics 2. 3 credits
Prerequisite: ASE 661. Small oscillations. Perturbation theory; methods of celestial mechanics. Numerical methods of orbit computation.

ASE 663—Astronautical Mechanics 3. 3 credits
Prerequisite: ASE 662. Lunar theory; orbits about an oblate spheroid; tumbling of an orbiting vehicle. Atmospheric entry problem.

ASE 670—Control Techniques in Aerospace Systems. 3 credits
Prerequisites: ASE 570, EE 474. Stability criteria. Techniques of feedback control with applications to aerospace systems. Use of computers in control system design.

ASE 671—Advanced Space Instrumentation Laboratory. 1 to 9 credits
Laboratory experiments relating to instrumentation of space vehicles. Scientific principles of instruments used or to be modified for space missions. May be repeated with change of content up to a maximum of 9 credits.

ASE 681—Advanced Aerospace Design. 1 to 9 credits
Advanced aerospace design projects. May be repeated with change of content up to a maximum of 15 credits.

ASE 684—Aerospace Research. 1 to 9 credits
May be repeated with change of content up to a maximum of 15 credits.

ASE 690—Graduate Seminar. 1 credit
Discussion of topics in fields of graduate study and research. May be repeated with change of content up to a maximum of 12 credits.

ASE 691—Special Topics in Aerospace Engineering. 1 to 9 credits
Laboratory, lectures, or conferences covering selected topics in aerospace engineering. May be repeated with change of content up to a maximum of 15 credits.
ASE 699—Master's Research. 1 to 17 credits
ASE 799—Doctoral Research. 1 to 17 credits

AGRICULTURAL ECONOMICS

GRADUATE FACULTY 1970-71

Tefertiller, K. R., *Chairman;* Alleger, D. E.; Boutwell, W. K.; Brooke, D. L.; Brooker, M. A.; Cake, E. W.; Clark, H. B.; Eddleman, B. R.; Gibbs, K. C.; Greene, R. E. L.; Greenman, J. R.; Langham, M. R.; McPherson, W. K.; McPherson, W. W.; Murphree, C. E.; Myers, L. H.; Polopolus, L.; Prato, A. A.; Reynolds, J. E.; Smith, C. N.; Spurlock, A. H.; Tyner, F. H.

Graduate Coordinator: F. H. Tyner

Graduate study is offered leading to the degrees of Master of Agriculture, Master of Science in Agriculture, and Doctor of Philosophy. Fields of study include production economics and supply, demand and marketing, community and rural development, natural resource economics, public policy, foreign economic development, and econometrics. The department participates in the programs of the Center for Latin American Studies and the Center for Tropical Agriculture. Students who hold the bachelor's degree with their major field of study in an area other than agricultural economics should consult with the graduate coordinator concerning acceptance for graduate study. In addition to the courses outlined, there are seminars for organized discussion of current topics and for review of graduate students' research.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

AS 501—Special Topics in Agricultural Economics. 1 to 3 credits
Maximum 6 credits
AS 510—Intermediate Agricultural Production Economics. 4 credits
AS 520—Intermediate Consumption Economics and Agricultural Marketing. 3 credits
AS 521—Case Studies of Agricultural Marketing Firms. 4 credits
AS 522—Firm Efficiency. 3 credits
AS 530—Natural Resource Utilization. 4 credits
AS 540—Income and Employment of Rural People. 5 credits
AS 541—Foreign Agricultural Development Planning. 5 credits
AS 565—Activity Analysis for Economic Decisions. 4 credits
AS 566—Elementary Econometrics. 3 credits

GRADUATE COURSES

AS 600—Science and Research Methodology. 3 credits
Investigation of role of science, philosophy, and the scientific method in re-

search. Emphasis on application of scientific methods to agricultural economics research.

AS 601—Procedures in Planning and Conducting Research. 3 credits
Concepts of research and the application of scientific methods in planning and conducting research in agricultural economics.

AS 602—Problems in Agricultural Economics. 1 to 3 credits
Prerequisite: Consent of instructor. Individual study in selected problem areas. Aspects of problems of interest to the student and agreeable to the instructor. May be repeated with change in content up to a maximum of 6 credits.

AS 603—Topics in Agricultural Economics. 1 to 3 credits
Prerequisite: Consent of instructor. Current developments in agricultural economics. May be repeated with change in content up to a maximum of 6 credits.

AS 610—Economics of Agricultural Production. 4 credits
Prerequisites: AS 460, ES 402. Microeconomic analysis of problems of producer choice. Principles are generalized to multi-factor, multi-product cases for various market structures. Empirical production, cost, and input demand functions are analyzed.

AS 611—Economics of Aggregate Output in Agriculture. 3 credits
Prerequisite: AS 610. Producer choices and consequences at the commodity and industry levels. Aggregate behavior of producers in relation to the welfare of society.

AS 612—Dynamics of Agricultural Production and Firm Growth. 4 credits
Prerequisite: AS 610. Dynamics of production and problems of firm growth. Effects of risk and uncertainty on the production process and application of decision theory in nonstatic contexts.

AS 620—Consumption and Demand: Farm Products and Marketing Services. 4 credits
Prerequisites: AS 460, ES 402. Theories of consumer behavior in static and dynamic contexts; analysis of household expenditure and demand.

AS 621—Industrial Organization of Agricultural Markets. 4 credits
Prerequisite: ES 302 or ES 402. Application of economic theory to analysis of market structure, conduct, and performance. Evaluation of current public policy and institutional arrangements.

AS 630—Natural Resource Economics. 4 credits
Prerequisites: AS 460, ES 401, and consent of instructor. Economic principles as they relate to natural resource development; economic objectives, criteria for evaluation, and agency use of criteria for natural resource development.

AS 631—Land Tenure and Taxation in Agriculture. 4 credits
Prerequisite: AS 430. Philosophy and history of property rights and taxation. Effects of property rights and taxes on factor employment, land use, output, land values, income distribution, and social welfare.

AS 640—Foundations of Agricultural Policies. 3 credits
Prerequisite: AS 440. Analysis of policy-making processes. Interrelationships among economic, political, and social goals, and actions which shape the institutional arrangements of the agricultural economy and its relations with other sectors.

AS 641—Agricultural Policies and Programs in the United States. 3 credits
Prerequisites: AS 440, ES 202. Theoretical and empirical treatment of relation

between goals and programs. Effects of policies on volume and location of output, prices, and income in the U. S. economy.

AS 643—REGIONAL INCOME ACCOUNTING FOR RURAL AREAS. 4 credits
Prerequisites: ES 401, ES 402. Regional accounting systems, including income and product, input-output, flow of funds, balance of payments, and the regional balance sheet. Constructing regional accounts for rural areas. Data requirements and availability. Accounting systems in rural area development policy.

AS 644—REGIONAL ECONOMIC PLANNING FOR RURAL AREAS. 4 credits
Prerequisites: AS 643; AS 660. General theory of regional and location economics. Analytical models for regional analysis; input-output, linear programming, location quotients, population and gravity models, and simulation techniques.

AS 645—ECONOMIC DEVELOPMENT AND AGRICULTURE. 5 credits
Prerequisites: ES 301; ES 302 or AS 301. Relation of technology, human, capital, and natural resources, and institutional arrangements to income growth and distribution. Development planning in low-income countries.

AS 646—AGRICULTURE'S ROLE IN THE GROWTH OF LATIN AMERICAN NATIONS. 4 credits
Agricultural developments in Latin America in relation to facts and theories of national growth, international relations, and hemispheric understanding and cooperation.

AS 650—INTERNATIONAL AGRICULTURAL POLICY AND TRADE. 5 credits
Prerequisites: AS 460, ES 341. Trade theory applied to international movement of agricultural products, inputs, and prices. International policies, agreements, and programs affecting agriculture.

AS 660—NONSTOCHASTIC MODELS. 5 credits
Identical with ES 660. Prerequisite: MS 324 or ISE 401. The general linear programming model and its basic theorems, integer and nonlinear programming. Spatial equilibrium, input-output, and game theory models.

AS 661—ECONOMETRIC METHODS 1. 5 credits
Identical with ES 661. Prerequisite: STA 441. Stochastic models. The general linear model and problems associated with its use in econometric research. Theory of the simultaneous equation approach, model construction, and estimation techniques.

AS 662—ECONOMETRIC METHODS 2. 4 credits
Identical with ES 662. Prerequisite: AS 661 or ES 661. Single equation topics; errors in variables, nonspherical disturbances, and lagged variables. Dynamic simultaneous equation models and miscellaneous topics in multivariate analysis. Spectral and cross-spectral analysis.

AS 663—RESEARCH SEMINAR IN ECONOMETRICS. 1 to 3 credits
Identical with ES 663. Prerequisite: AS 661 or ES 661. Empirical measurement in applied economics. Empirical problems requiring the construction, estimation, and defense of a quantitative economic model.

AS 697—SUPERVISED RESEARCH. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

AS 698—SUPERVISED TEACHING. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

AS 699—MASTER'S RESEARCH. 1 to 17 credits

AS 799—DOCTORAL RESEARCH. 1 to 17 credits

AGRICULTURAL ENGINEERING

GRADUATE FACULTY 1970-71

SMERDON, E. T., *Chairman*; BAGNALL, L. O.; CHOATE, R. E.; FLUCK, R. C.; KINARD, D. T.; MYERS, J. M.; NORDSTEDT, R. A.; OVERMAN, A. R.; SHAW, L. N.; SKINNER, T. C.; WHITNEY, J. D.

Graduate Coordinator: R. C. FLUCK

Prerequisite for admission to graduate study in agricultural engineering is a bachelor's degree from a curriculum essentially equivalent to the undergraduate curriculum in agricultural engineering at the University of Florida. However, a student with a degree in a related field may, with a moderate amount of supporting coursework, complete requirements for a master's degree within a calendar year. Students interested in graduate work in agricultural engineering should consult departmental advisers to discuss possible programs.

Candidates for the master's degree normally will be required to take AGE 601, AGE 602, AGE 603, and at least one course from the list AGE 670, AGE 671, AGE 672, AGE 673, or AGE 674. Depending upon degree objective, variations from this list may be approved. Prerequisite for admission to any of the agricultural engineering courses is the approval of the instructor.

The following *Engineering Common Courses* are available for graduate major credit: EGC 541—Tensor Fields and Fluid Dynamics; EGC 621—Surface Hydrology.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

AGE 555—ANIMAL WASTE MANAGEMENT. 5 credits

GRADUATE COURSES

AGE 601—SEMINAR. 1 credit

Discussions of research, current trends, and practices in agricultural engineering.

AGE 602—RESEARCH METHODS IN AGRICULTURAL ENGINEERING. 3 credits

AGE 603—INSTRUMENTATION IN AGRICULTURAL ENGINEERING RESEARCH. 4 credits

Principles and application of measuring instruments and devices for obtaining experimental data in agricultural engineering research.

AGE 670—NON-THESIS RESEARCH IN AGRICULTURAL ENGINEERING. 0 to 5 credits

Special problems in agricultural engineering. May be repeated with change of content up to a maximum of 10 credits.

AGE 671—ADVANCED SOIL AND WATER MANAGEMENT ENGINEERING. 4 credits

Selected problems of land improvement and the control and use of water for agricultural production.

AGE 672—Advanced Farm Machinery. 4 credits

Agricultural machines, power units, and mechanized systems with emphasis on functional design requirements; evaluation of performance of those machines and systems.

AGE 673—Advanced Farm Buildings. 4 credits

Selected problems of design criteria for farm structures, particularly as related to efficient production systems.

AGE 674—Advanced Agricultural Process Engineering. 4 credits

Engineering problems dealing with the handling and processing of agricultural products.

AGE 699—Master's Research. 1 to 17 credits

AGRONOMY

GRADUATE FACULTY 1970-71

McCloud, D. E., *Chairman;* Clark, F.; Edwardson, J. R.; Gascho, G. J.; Goddard, R. E.; Hinson, K.; Horn, G. C.; Horner, E. S.; Killinger, G. B.; Mott, G. O.; Norden, A. J.; Pfahler, P. L.; Prine, G. M.; Rodgers, E. G.; Ruelke, O. C.; Schank, S. C.; Schroder, V. N.; Smith, R. L.; Stanley, R. G.; Wallace, A. T.; Warmke, H. E.; West, S. H.; Whitty, E. B.; Wilcox, M.

Graduate Coordinator: E. G. Rodgers

The Department of Agronomy offers major work for the degrees of Master of Agriculture, Master of Science in Agriculture, and Doctor of Philosophy. Areas of specialization are crop ecology, crop nutrition and physiology, forages and pastures, weed science, cytogenetics, genetics, and plant breeding. *Prerequisites* include a background in science, with basic courses in mathematics, chemistry, physics, botany, and bacteriology. Minor work is offered students taking major work in other departments. Students wishing to take major or minor work in agronomy should consult the department chairman or graduate coordinator.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

AY 513—Oilseed Crops. 4 credits

AY 514—Fiber Crops. 4 credits

AY 536—Tropical Pasture and Forage Science. 5 credits

GRADUATE COURSES

AY 641—Crop Nutrition. 4 credits

Prerequisite: BTY 310. Nutritional influences on differentiation, composition, growth, and yield of agronomic plants.

AY 642—Biochemistry of Herbicides. 4 credits
Prerequisite: CY 565. Mechanism of action, metabolism, and structure-activity relationships of herbicides.

AY 644—Physiology of Agronomic Plants. 4 credits
Prerequisite: BTY 515. Yield potentials of crops as influenced by photosynthetic efficiencies, respiration, translocation, drought, and canopy architecture.

AY 646—Crop Ecology. 5 credits
Prerequisite: AY 311, AY 432, or BTY 501. Influence and interaction of environmental factors, such as climatic, edaphic, pyric, and biotic, on the development and distribution of crop plants.

AY 647—Crop Plants in Tropical Environments. 12 credits
Prerequisite: Approval by Organization for Tropical Studies. Factors determining growth, development, and production of crop plants in tropical environments.

AY 658—Population Genetics. 3 credits
Prerequisites: AY 362, STA 520. Application of statistical principles to biological populations in relation to gene frequency, zygotic frequency, mating systems, and the effects of selection, mutation, and migration on equilibrium populations.

AY 660—Cytogenetics. 5 credits
Prerequisites: Basic courses in genetics and cytology. Genetic variability with emphasis on interrelationships of cytologic and genetic concepts. Chromosome structure and number, chromosomal aberrations, apomixis, and application of cytogenetic principles.

AY 662—Advanced Genetics. 4 credits
Prerequisites: AY 362; AY 465 or ADP 322. Advanced genetic concepts and modern genetic theory.

AY 664—Topics in Genetics. 2 to 4 credits
Identical with AL 664, BTY 696, DY 664, PY 664, ZY 664. Prerequisite: AY 362 or ZY 325. Biochemical, bacterial, viral, statistical, radiation, serological, and human genetics; speciation, history of genetics, genetics of higher plants and animals. May be repeated with change of content up to a maximum of 12 credits.

AY 665—Advanced Plant Breeding. 4 credits
Prerequisites: AY 362, AY 465, STA 521. Genetic basis for plant breeding procedures.

AY 682—Genetics Seminar. 1 credit
Current literature and developments in genetics. May be repeated with change of content up to a maximum of 3 credits.

AY 684—Graduate Agronomy Seminar. 1 credit
Current literature and agronomic developments. Required of all graduate students in Agronomy. May be repeated with change of content up to a maximum of 3 credits.

AY 686—Agronomic Problems. 1 to 6 credits
Prerequisite: Minimum of one undergraduate course in agronomy or plant science. Special topics for classroom, library, laboratory, or field studies of agronomic plants. May be repeated with change of content up to a maximum of 12 credits.

AY 688—Topics in Agronomy. 2 to 4 credits
Selected topics in specific agronomic areas critically reviewed. May be repeated with change of content up to a maximum of 12 credits.

AY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

AY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
AY 699—Master's Research. 1 to 17 credits
AY 799—Doctoral Research. 1 to 17 credits

ANIMAL SCIENCE

GRADUATE FACULTY 1970-71

Cunha, T. J., *Chairman;* Ammerman, C. B.; Arrington, L. R.; Bazer, F. W.,; Beardsley, D. W.; Bertrand, J. E.; Bradley, R. E.; Cardeilhac, P. T.; Carpenter, J. W.; Chapman, H. L.; Christiansen, W. C.; Combs, G. E., Jr.; Crockett, J. R.; Davis, G. K.; Edds, G. T.; Feaster, J. P.; Franke, D. E.; Fry, J. L.; Glenn, J. C.; Harms, R. H.; Hayes, B. W.; Head, H. H.; Hentges, J. F., Jr.; Houser, R. H.; Koger, M.; Loggins, P. E.; Marshall, S. P.; Moore, J. E.; Ott, E. A.; Palmer, A. Z.; Shirley, R. L.; Thatcher, W. W.; Van Horn, H. H.; Wallace, H. D.; Warnick, A. C.; White, F. H.; Wilcox, C. J.; Wilson, H. R.; Wing, J. M.

Graduate Coordinator: A. C. Warnick

The Department of Animal Science offers the degrees of Master of Agriculture, Master of Science in Agriculture, and Doctor of Philosophy in the following areas: (1) animal nutrition, (2) meats, (3) animal breeding and genetics, and (4) animal physiology. A student may work on a problem covering more than one area of study. Large animals (beef cattle, dairy cattle, swine, poultry, and sheep) and laboratory animals are available for various research problems. Adequate nutrition and meats laboratories are available for detailed chemical and carcass quality evaluations. Special arrangements can be made for conduction of research problems at the various branch agricultural experiment stations throughout Florida. A Ph.D. degree may be obtained in Animal Science with dissertation research under the direction of members of the Departments of Dairy Science, Poultry Science, Veterinary Science, and Animal Science.

Departmental prerequisites for admission to graduate study include a sound science background, with basic courses in bacteriology, biology, mathematics, botany, and chemistry.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

AL 527—Animal Nutrition. 5 credits

GRADUATE COURSES

AL 601—Topics in Animal Science. 4 credits
New developments in animal nutrition and livestock feeding, animal genetics, animal physiology, and livestock management.

AL 602—Quantitative Genetics. 5 credits
Prerequisites: STA 320, AY 362. Genetic and biometric principles underlying genetic characters that exhibit continuous variation.

AL 604—Meat Technology. 4 credits
Chemistry, physics, histology, bacteriology, and engineering involved in the handling, processing, manufacturing, preservation, storage, distribution; and utilization of meat.

AL 605—Experimental Technics and Analytical Procedures in Meat Research. 4 credits
Experimental design, analytical procedures; technics; carcass measurements and analyses as related to livestock production and meat studies.

AL 607—Physiology of Reproduction. 4 credits
Anatomy, histology, and physiology of genital organs. Estrous cycle changes in the female. Semen production in the male and artificial insemination.

AL 609—Problems in Animal Science. 1 to 6 credits
May be repeated with change of content up to a maximum of 12 credits.

AL 650—Advanced Methods in Nutrition Technology. 4 credits
Prerequisite: CY 204. For graduate students but open to seniors by special permission. Demonstrations and limited performance of procedures used in nutrition research.

AL 651—Advanced Animal Nutrition. 4 credits
Prerequisite: CY 371. Proteins, carbohydrates, lipids, vitamins, and minerals related to enzyme activity and energy.

AL 652—Advanced Animal Nutrition Laboratory. 3 credits
Prerequisite: CY 371. Accompanying laboratory course for AL 651.

AL 653—Vitamins. 4 credits
Prerequisite: Organic chemistry. Historical development, properties, assays, and physiological effects.

AL 654—Laboratory in Vitamins. 2 credits
Chemical determination and assay procedures. Accompanying laboratory course for AL 653.

AL 655—Mineral Nutrition and Metabolism. 4 credits
Physiological effort of macro- and micro-elements, mineral interrelationships.

AL 656—Ruminant Physiology and Metabolism. 3 credits
Prerequisite: AL 527. A review and correlation of the fundamental biochemical, physiological, and bacteriological research upon which the feeding of ruminants is based. Experimental methodology of rumen physiology and metabolism.

AL 657—Non-Ruminant Metabolism. 3 credits
Prerequisite: AL 527. Basic principles affecting absorption and assimilation of nutrients required for growth, reproduction, and lactation of swine and small laboratory animals.

AL 658—Equine Nutrition and Physiology. 3 credits
Prerequisite: AL 527 and consent of instructor. Principles affecting absorption and assimilation of nutrients and basic physiology of growth, reproduction, and exercise of the horse.

AL 659—Genetics of Animal Improvement. 4 credits
Prerequisite: AL 602. Continuation of AL 602. Application of statistical techniques and design in animal breeding research.

AL 660—Graduate Seminar in Animal Science. 1 credit

AL 664—Topics in Genetics. 2 to 4 credits
Identical with AY 664, BTY 696, DY 664, PY 664, ZY 664. May be repeated with change of content up to a maximum of 12 credits.
AL 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
AL 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
AL 699—Master's Research. 1 to 17 credits
AL 799—Doctoral Research. 1 to 17 credits

ANIMAL SCIENCE—GENERAL

The three Departments of Animal, Poultry, and Dairy Sciences have combined their curricula into an Animal Science Curriculum. ADP 535 is a cross-departmental course taught by the staff of the three departments.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

ADP 535—Animal Production in the Tropics. 4 credits

ANTHROPOLOGY

GRADUATE FACULTY 1970-71

Moore, G. A., Jr., *Acting Chairman*; Bullard, W. R., Jr.; Carter, W. E.; Du Toit, B. M.; Fairbanks, C. H.; Hardman-De-Bautista, M. J.; Heighton, R. H., Jr.; Kimball, S. T.; Maples, W. R.; Margolis, M. L.; Markel, N. N.; Nunez, T. A., Jr.; Taylor, C. D.

Graduate Coordinator: M. J. Hardman-de-Bautista

Graduate work leading to the Master of Arts and Doctor of Philosophy degrees is offered in the following fields of anthropology: social anthropology, ethnology, archeology, physical anthropology, and linguistics.

The Bachelor of Arts degree with major in anthropology is not required for admission to graduate work in the department, but students without such preparation should expect to make up any deficiencies in background information. A reading knowledge of one modern foreign language is required for the Master of Arts degree.

The normal distribution of work is as follows: (1) APY 600, Methods and Materials for Research; (2) at least two area courses (North American, South American, African, etc.); (3) at least one theory course each in ethnology, physical anthropology, archeology, and either linguistics or language and culture; (4) a written comprehensive examination; and (5) sufficient credits in APY 699 to prepare the required thesis.

The degree requirements, including the thesis, should be completed in five or six quarters.

The doctoral program involves three fields of specialization. There is a written and oral qualifying examination. Doctoral students should be prepared to work out their individual programs with their supervisory committees early in their residence.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

APY 500—Field Sessions in Archeology. 8 credits
APY 501—Principles of Archeology. 5 credits
APY 503—Introduction to Linguistic Field Methods. 5 credits
APY 504—Social Organization. 4 credits
APY 506—Language and Culture. 4 credits
APY 507—Culture and Personality 4 credits
APY 517—Cultural Revitalization. 4 credits
APY 518—Human Organization and Change. 4 credits
APY 520—Regional Cultures of Oceania. 4 credits
APY 540—The Tribal Peoples of Lowland South America. 4 credits
APY 541—Native Peoples of Mexico, Central America, and the Caribbean. 4 credits
APY 542—The Peoples of Brazil. 4 credits
APY 543—Peoples of the Andes. 4 credits
APY 545—Caribbean Cultural Patterns. 4 credits
APY 551—African Urbanization. 4 credits
APY 563—Methodological Foundations for Anthropology. 4 credits
APY 564—Quantitative Methods for Anthropology. 4 credits
APY 572—Paleoanthropology. 4 credits
APY 573—Human Osteology and Osteometry. 4 credits
APY 580—Anthropological Theory. 4 credits
APY 581—Current Anthropological Theory. 4 credits

GRADUATE COURSES

APY 600—Methods and Materials for Research. 2 credits
Research methods in anthropology. Bibliography. Relationship between subfields. Required of all graduate students.

APY 601—Principles of Anthropology. 3 credits
Physical anthropology, anthropological linguistics, world prehistory. Emphasis on the theoretical principles of each division and their interrelationships.

APY 602—Principles of Cultural Anthropology. 3 credits
Nature of culture, social organization, and culture and personality. Theoretical orientations in topical and area studies with emphasis on cultural dynamics.

APY 604—Principles of Political Anthropology. 4 credits
Problems of identifying political behavior. Natural leadership in tribal societies. Acephalous societies and republican structures. Kingship and early despotic states. Theories of bureaucracy.

APY 610—Medical Anthropology. 4 credits
Prerequisite: SY 514. Theory of anthropology as applied to nursing, medicine, hospital organization, and the therapeutic environment. Course includes instrument design and techniques of material collection.

APY 611—Advanced Archeological Field Methods. 9 credits
Prerequisites: APY 300, APY 500, APY 501. Planning, directing, and reporting archeological excavations. Students are encouraged to prepare publishable papers.

APY 612—Ethnographic Field Methods. 4 credits
Methods for collecting ethnographic data. Entry into the field; role and image conflict. Participant observation, interviewing, content analysis, cross checking, and analysis of data.

APY 615—Problems of National Integration in Latin America. 4 credits
Conceptual problems of the society and culture of selected nation-states: nationalism, urbanization, peasant revitalization movements, as integrative or divisive forces. Vertical institutions: church, school, markets, plantation, in particular communities.

APY 620—Directed Culture Change in Latin America. 4 credits
Utopias in Latin American culture history. The Spanish Conquest as a social experiment. The post Independence Liberal Reforms and social resolutions, compared with contemporary attempts at community development.

APY 621—Seminar in Archeology. 5 credits
Prerequisite: APY 501. Seminar in a selected archeological topic. May be repeated with change of content up to a maximum of 15 credits.

APY 622—Seminar in Ethnology. 5 credits
Prerequisite: APY 504. Seminar in a selected ethnological topic. Areas treated are North America, Central America, South America, Africa, Oceania. May be repeated with change of content up to a maximum of 15 credits.

APY 623—Seminar in Physical Anthropology. 5 credits
Prerequisite: APY 302. Seminar in a selected topic of physical anthropology. May be repeated with change of content up to a maximum of 15 credits.

APY 625—Man and Culture in Southern Africa. 4 credits
Prehistoric times through first contacts by explorers to settlers; the contact situation between European, Khoisan, and Bantu-speaking; empirical data dealing with present political, economic, social, and religious conditions.

APY 630—Individual Work. 3 to 5 credits
Guided readings on research in anthropology based on library, laboratory or field work. May be repeated with change of content up to a maximum of 15 credits.

APY 640—Seminar on the Anthropology of Latin America. 4 credits
Prerequisites: Reading knowledge of Spanish or Portuguese and consent of the instructional staff. Materials from the major branches of anthropology. May be repeated with change of content up to a maximum of 12 credits.

APY 645—Evolution of Culture. 4 credits
Prerequisite: APY 300. Theories of culture growth and evolution from cultural beginnings to dawn of history. Major inventions of man and their significance.

APY 661—Anthropology and Education. 5 credits
Comparative study of the teaching and learning processes in societies of differing complexity and cultural variability. Empirical data examined from an anthropological perspective and in the context of theories about culture and perception, world view, rites of passage, culture and personality, and change.

APY 667—Culture and Community. 5 credits
Prerequisite: 15 to 20 credits in social sciences. Examination of the method and theory of the empirical, inductive, natural history approach in the study of

communities. Existing community studies are utilized to provide comparative analyses of social structure, culture patterns, and process of change.

APY 668—Seminar in Structure and Process in the Urban Environment. 4 credits

Prerequisites: APY 434 and APY 435; or consent of instructor. An anthropological view of the city through the interaction of special and temporal behavior, ecology, culture institutions, and urban morphology.

APY 675—Pattern, Structure, and Process. 5 credits

Prerequisite: 15 to 20 credits in social sciences. Advanced seminar in the theory of social anthropology.

APY 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

APY 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

APY 699—Master's Research. 1 to 17 credits

APY 799—Doctoral Research. 1 to 17 credits

ARCHITECTURE

GRADUATE FACULTY 1970-71

Butt, A. F., *Chairman*; Arnett, W. T.; Branch, D. P.; Dallerba, M. G.; Dasta, A. J.; Grand, J. L. R.; Hamacher, H. B.; Kemp, H. W.; Kinzey, B. Y., Jr.; Larrick, T.; Merritt, H. C.; Reeves, F. B.; Ricci, L.; Sabatella, J. J.; Smith, H. H.; Solis, M. M.; Wagner, W. G.; Wetterqvist, O. F.

Graduate Coordinator: H. W. Kemp

The Department of Architecture offers graduate work leading to the degree of Master of Arts in Architecture. The degree Bachelor of Design with appropriate studies in architecture or a degree determined by the department to be equivalent is prerequisite to admission. Graduation from an accredited school of architecture having a five-year course of study is acceptable. In addition to satisfying University requirements for admission, applicants must submit supplementary material to the Department of Architecture which is indicative of his professional competence. The applicant should request detailed instructions relative to the submission which is usually presented in graphic, written, or photographic form.

The student is expected to pursue studies related to his special field of interest in architectural design, architectural history, architectural structures, environmental systems, architectural preservation, or urban design. Additional information concerning programs for each of these areas is available from the department.

Students will be allowed to enter the program in the fall and winter quarters only; but because of limited course offerings, they should not plan on taking more than three consecutive quarters without a one-quarter interruption. Students are urged to seek experience in architectural offices dur-

ing periods when they are not in school. Two years in residence are normally required for the completion of the requirements.

At the present time holders of a five-year undergraduate degree in Architecture may complete the requirements for the master's degree in one calendar year. The minimum registration required is 45 credits, including 9 credits in 699. However, this program is being terminated and, except in special cases, the degree for this program will not be awarded after June 30, 1973.

The department reserves the right to retain student work for the purposes of record, exhibition, or instruction.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

AE 511—Advanced Communications Techniques. 3 to 5 credits
AE 521—Professional Administration. 4 credits
AE 552—Architectural Structures—Advanced Studies. 5 credits
AE 561—Architectural Acoustics. 4 credits
AE 571—Problems in Architectural History. 4 credits
AE 572—Studies in Architectural Theory. 4 credits
AE 581—Survey of Architectural Preservation, Restoration, and Reconstruction. 4 credits
AE 582—Techniques of Architectural Documentation. 4 credits
AE 583—Historic Preservation and Restoration: Interiors. 4 credits
AE 584—Historic Preservation and Restoration: Landscape Architecture. 4 credits

GRADUATE COURSES

AE 601—Graduate Seminar. 3 to 5 credits
Required of all graduate students. May be repeated with change of content up to a maximum of 9 credits.

AE 602—Urban Design Theory Seminar 1. 4 credits
Contemporary theories and methodologies of urban design.

AE 603—Urban Design Theory Seminar 2. 4 credits
Prerequisite: AE 602. Continuation of AE 602 including selection of methodology to be used in thesis research.

AE 621—Architectural Research. 3 to 9 credits
Investigation of a problem in a field of architecture. May be repeated with change of content up to a maximum of 9 credits.

AE 622—Urban Design Research. 3 to 9 credits
Investigation of a problem in a field of architecture. May be repeated with change of content up to a maximum of 9 credits.

AE 631—Architectural Design 1. 5 credits*
Design of buildings, limitations of site topography, utilities, and relationship to other structures.

AE 632—Architectural Design 2. 8 credits
Prerequisite: AE 631. Design of buildings within an urban complex. Forces of physical and social planning which influence the design.

AE 633—Architectural Design 3. 8 credits
Prerequisite: AE 631. Design of buildings within an architectural complex of established character in collaboration with students in master's history program.

AE 634—Architectural Design 4. 8 credits
Prerequisite: AE 633. Design in detail of an individual building.

AE 635—Architectural Design 5. 4 credits
Prerequisite: AE 634. Collaboration with students in AE 652 and AE 662. Structure and mechanical equipment.

AE 641—Urban Design Studio 1. 5 credits
Design of building and facilities for urban development at scale of group and neighborhood.

AE 642—Urban Design Studio 2. 5 credits
Design of buildings and facilities for urban development at scale of group, neighborhood and town.

AE 643—Urban Design Studio 3. 5 credits
Prerequisite: AE 642. Continuation of AE 642 at the scale of megalopolis.

AE 644—Urban Design Studio 4. 5 credits
Prerequisite: AE 643. Continuation of AE 643 at the territorial scale.

AE 645—Urban Design Studio 5. 5 credits
Prerequisite: AE 644. Continuation of AE 644.

AE 646—Technology in Urban Design. 4 credits
Application of systems construction in buildings and facilities to urban design problems.

AE 650—Structural Design Laboratory 1. 4 credits
Corequisite: AE 651. Problems in the design of simple determinate frames in wood and steel.

AE 651—Applied Structural Design 1. 4 credits
Corequisite: AE 650. Lecture portion of AE 650. Elementary design in wood and steel.

AE 652—Structural Design Laboratory 2. 4 credits
Prerequisites: AE 650, AE 651. Corequisite: AE 653. Problems in the design of concrete members and frames including prestressed members.

AE 653—Applied Structural Design 2. 4 credits
Prerequisites: AE 650, AE 651. Corequisite: AE 652. Lecture portion of AE 652. Elementary design in concrete.

AE 654—Structural Design Laboratory 3. 4 credits
Prerequisites: AE 652, AE 653. Corequisite: AE 655. Problems involving two- and three-dimensional trussed frames and elementary frames of variable cross-section.

AE 655—Applied Structural Design 3. 4 credits
Prerequisite: AE 652. Corequisites: AE 653, AE 654. Lecture portion of AE 654. Elementary design in trusses and space frames.

AE 656—Structural Design Laboratory 4. 4 credits
Prerequisites: AE 654, AE 655. Corequisite: AE 657. Problems in design of shells, domes, and other special structures.

AE 657—Applied Structural Design 4. 4 credits
Prerequisites: AE 654, AE 655. Corequisite: AE 656. Lecture portion of AE 656. Design of shells, domes, and other special structures.

AE 658—Structural Design Laboratory 5. 4 credits
Prerequisites: AE 656, AE 657. Directed studies and problems in collaboration with a team of students involving a coordinated building design. Architectural, structural, and environmental aspects of a problem developed as a total, compatible concept.

AE 659—Structural Design Laboratory 6. 4 credits*
May be taken concurrently with AE 658 or as a continuation of AE 658 to adjust to the breadth or length of the design problem assigned.

AE 660—Environmental Systems Design Laboratory 1. 4 credits
Prerequisite: AE 561. Corequisite: AE 661. Problems in acoustics analysis and design.

AE 661—Environmental Systems Design 1. 4 credits
Prerequisite: AE 561. Corequisite: AE 660. Applications of sound control in buildings, auditorium design, and noise control.

AE 662—Environmental Systems Design Laboratory 2. 4 credits
Corequisite: AE 663. Applied design of lighting, electric power distribution, and plumbing system for buildings.

AE 663—Environmental Systems Design 2. 4 credits
Corequisite: AE 662. Lecture portion of AE 662.

AE 664—Environmental Systems Design Laboratory 3. 4 credits
Corequisite: AE 665. Applied design of heating and air-conditioning systems for buildings.

AE 665—Environmental Systems Design 3. 4 credits
Corequisite: AE 664. Lecture portion of AE 664.

AE 666—Environmental Systems Design Laboratory 4. 4 credits
Prerequisites: AE 664, AE 665. Corequisite: AE 667. Special studies in environmental systems related to current developments. Total energy systems, solar energy, heat conservation, and similar contemporary problems and trends.

AE 667—Environmental Systems Design 4. 4 credits
Prerequisites: AE 664, AE 665. Corequisite: AE 666. Lecture portion of AE 666.

AE 668—Environmental Systems Design Laboratory 5. 4 credits
Prerequisites: AE 660, AE 661, AE 662, AE 663, AE 664, AE 665, AE 666, AE 667. Directed studies and problems in collaboration with a team of students involving a coordinated building design. Architectural, structural, and environmental aspects of a problem developed as a total, compatible concept.

AE 669—Environmental Systems Design Laboratory 6. 4 credits*
May be taken concurrently with AE 668 or as a continuation of AE 668 to adjust to the breadth or length of the design problem assigned.

AE 671—Architectural History 1. 5 credits*
Prerequisite: 9 credits of architectural history. History of western civilization with emphasis on architectural developments in their historical, physical, ideological, artistic, and social context.

AE 672—Architectural History 2. 5 credits
Prerequisite: AE 671. Continuation of AE 671.

AE 673—Architectural History 3. 5 credits
Prerequisite: AE 672. Continuation of AE 672.

*Variable credits of 3 to 9 for one-year graduate program only.

AE 674—Architectural History: Area Concentration. 5 credits
Prerequisite: AE 673. Development of techniques for research in architectural history. May be repeated with change of content up to a maximum of 15 credits.

AE 677—Architectural History: Literature and Criticism. 5 credits
Prerequisite: AE 671. Individual research with concentration on writing and architectural criticism. May be repeated with change of content up to a maximum of 15 credits.

AE 678—History of Urban Design. 5 credits
Historical development of cities. Consideration of cultural, social, economic influences with emphasis on physical development.

AE 681—Architectural History: American 1. 5 credits
Prerequisite: 9 credits of architectural history. Development of American architecture and the determinants affecting its function, form, and expression.

AE 682—Architectural History: American 2. 5 credits
Prerequisite: AE 681. Continuation of AE 681.

AE 683—Architectural History: Regional. 5 credits
Prerequisite: AE 682. Group and individual studies of architecture unique to specific geographic regions.

AE 684—Architectural History: Florida. 5 credits
Chronological historic survey of Florida's architecture.

AE 685—Technology of Restoration: Materials and Methods 1. 4 credits
Prerequisite: AE 581. Materials, elements, tools, and personnel of traditional building.

AE 686—Technology of Restoration: Materials and Methods 2. 4 credits
Prerequisite: AE 685. Continuation of AE 685.

AE 687—Technology of Restoration: Structural and Mechanical Systems. 4 credits
Prerequisite: AE 685. Applications of structural and mechanical systems to the process of restoration.

AE 688—Technology of Restoration: Techniques of Preservation, Restoration, and Reconstruction. 4 credits
Prerequisite: AE 685. Initiating, financing, realizing, and maintaining restored architecture.

AE 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

AE 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

AE 699—Master's Research. 1 to 17 credits

ART

GRADUATE FACULTY 1970-71

Grissom, E. E., *Chairman*; Flam, J. D.; Holbrook, H. H.; Kerslake, K. A.; Naylor, J. G.; Purser, S. R.; Uelsmann, J. N.; Ward, P. A.; Williams, H. D.

Graduate Coordinator: E. E. Grissom

Master of Fine Arts Degree: The Department of Art offers graduate work leading to the degree of Master of Fine Arts. An undergraduate major in art with adequate preparation in studio courses in fine arts and in the history and theory of art is prerequisite to admission. Applicants for admission must submit a portfolio. Graduate work is divided between studio courses in ceramics, creative photography, drawing, painting, printmaking, and sculpture, and advanced study in the history of art. Two years of residence are normally required for completion of the requirements for this degree.

ART 500 is required of all graduate majors. All graduate courses may be repeated for credit with change of content. Some of the courses listed are offered regularly, while others are offered only as needed.

Graduate minors in the history of art: The graduate seminars are open to students minoring in the history of art, provided that suitable prerequisites have been completed. Courses in history, philosophy, or literature may often be substituted for prerequisites in art.

The department reserves the right to retain student work for the purposes of record, exhibition, or instruction.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ART 500—Methods of Research and Bibliography. 4 credits
ART 551—Individual Work. 4 or 6 credits

GRADUATE COURSES

ART 611—Seminar: Problems in Renaissance and Baroque Art. 4 credits
Prerequisites: ART 309, one undergraduate course in Renaissance or Baroque art.

ART 621—Seminar: Problems in 19th and 20th Century Art. 4 credits
Prerequisites: ART 309, one undergraduate course in 19th or 20th century art.

ART 622—Seminar: Problems in Contemporary Art. 4 credits
Prerequisites: ART 309, one undergraduate course in 19th or 20th century art.

ART 650—Advanced Drawing. 4 credits
Prerequisite: ART 450.

ART 651—Advanced Projects: Studio. 4 or 6 credits
Prerequisite: A major in fine arts. Advanced projects in ceramics, drawing, painting, printmaking, creative photography, or sculpture.

ART 655—Research in Methods and Materials of the Artist. 4 or 6 credits

ART 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

ART 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

ART 699—Master's Research. 1 to 17 credits

ARTS AND SCIENCES—GENERAL

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ASC 501—Ancient and Medieval Science. 3 credits
ASC 502—The Scientific Revolution. 3 credits
ASC 503—Science since Newton. 3 credits
ASC 542—History of Biological Science. 3 credits

GRADUATE COURSES

ASC 641—Internship in College Teaching. 3 credits
Prerequisite: Permission of the graduate major department. Required of all candidates for the Master of Arts in Teaching and the Master of Science in Teaching degrees.

ASC 642—Internship in College Teaching. 3 credits
Continuation of ASC 641. May be taken concurrently with ASC 641.

ASC 643—Internship in College Teaching. 3 credits
Continuation of ASC 642. May be taken concurrently with ASC 642.

ASTRONOMY

GRADUATE FACULTY 1970-71

Smith, A. G., *Chairman;* Carr, T. D.; Chen, K-Y; Gleim, J. K.; Green, A. E. S.; Lebo, G. R.; Omer, G. C., Jr.; Prasad, S. S.; Wood, F. B.

Graduate Coordinator: G. R. Lebo

The Department of Astronomy offers graduate work in astrophysics or aeronomy leading to the degrees Master of Science and Doctor of Philosophy. Current research fields include radio astronomy, cosmology, photoelectric photometry of eclipsing binaries, photographic photometry of quasars, spectroscopy, and aeronomy. For unqualified admission to the program, a student should have an acceptable undergraduate degree in physics or astronomy. Students with degrees in related fields, such as engineering or mathematics, may be admitted with the understanding that certain foundation courses will have to be taken. If he so desires, an individual with a strong background in physics may perform his graduate research work in astronomy or aeronomy, but take his qualifying examination and degree in physics, rather than astronomy. Complete details of the program and the research facilities are included in an illustrated booklet that can be obtained by writing the *Chairman for Astronomy, Room 231, Space Sciences Research Building.*

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ATY 503—History of Astronomy. 3 credits
ATY 510—Solar System Astrophysics 1. 3 credits

ATY 511—Solar System Astrophysics 2. 3 credits
ATY 521—Positional Astronomy 1. 3 credits
ATY 522—Positional Astronomy 2. 3 credits

GRADUATE COURSES

ATY 601—Celestial Mechanics 1. 3 credits
Prerequisites: ATY 317, PS 500. Analytical and numerical computation of orbits. First half of ATY 601-602.

ATY 602—Celestial Mechanics 2. 3 credits
Prerequisite: ATY 601. Second half of ATY 601-602.

ATY 605—Stellar Astrophysics 1. 3 credits
Prerequisites: ATY 316, ATY 317. Theoretical and observational approach to evolution, dynamics, and equilibria of stars and star systems.

ATY 606—Stellar Astrophysics 2. 3 credits
Prerequisite: ATY 605. Continuation of ATY 605.

ATY 607—Stellar Astrophysics 3. 3 credits
Prerequisite: ATY 606. Continuation of ATY 606.

ATY 608—Galactic Structure. 3 credits
Kinematics and dynamics of the galaxy.

ATY 611—Radio Astronomy 1. 3 credits
Prerequisites: ATY 316, ATY 317. Corequisites: PS 510 and PS 515. Measurement parameters; instrumentation of radio and radar astronomy; emission mechanism theories; radio propagation in plasmas; observational results of radio and radar astronomy and their interpretation.

ATY 612—Radio Astronomy 2. 3 credits
Prerequisite: ATY 611. Continuation of ATY 611.

ATY 613—Radio Astronomy 3. 3 credits
Prerequisite: ATY 612. Continuation of ATY 612.

ATY 621—Astronomical Techniques 1. 3 credits
Prerequisite: ATY 317. Theory and practice in the design and use of astronomical instruments; observation and reduction procedures used in applications such as astronomical photography, spectroscopy, and photo-electric photometry.

ATY 622—Astronomical Techniques 2. 3 credits
Prerequisite: ATY 621. Continuation of ATY 621.

ATY 631—Extragalactic Astronomy and Cosmology. 3 credits
Methods of modern cosmology; cosmological models.

ATY 633—Radiopropagation and Ionospheric Physics 1. 3 credits
Identical with PS 633. Prerequisite: PS 410 or equivalent. Propagation of electromagnetic waves in a magneto-ionic medium; scattering from density fluctuations; whistlers; models of neutral atmosphere; neutral winds; atomic, molecular, and plasma properties of ionospheric interest.

ATY 634—Radiopropagation and Ionospheric Physics 2. 3 credits
Identical with PS 634. Prerequisite: ATY 633. Ionospheric electron density and ion composition profiles; diurnal, seasonal, and global variations; pre-sunrise effects; electron and ion temperatures; traveling disturbances; solar flare and magnetic storm effects.

ATY 636—Atomic Physics of Planetary Atmospheres. 3 credits
Identical with PS 636. Prerequisites: Basic physics courses and mathematics

courses through integral calculus. Atomic and quantum theory, quantum mechanics and the central field problem, atomic and molecular spectroscopy, collisional cross sections for aeronomy.

ATY 637—Physics of the Earth's Upper Atmosphere. 3 credits
Identical with PS 637. Prerequisite: ATY 636. Solar-terrestrial relations, aurora, airglow, and ionospheric phenomena. Remote sensing of atmospheric emissions and scattered solar radiation.

ATY 638—Physics of Planetary Atmospheres. 3 credits
Identical with PS 638. Prerequisite: ATY 637. Radiative transfer in planetary atmospheres, from the x-ray to radio regions. Discussion of recent studies of the atmospheres of Venus, Mars, Jupiter, and other planets.

ATY 643—Visual and Spectroscopic Binary Stars 1. 3 credits
Prerequisites: ATY 605, ATY 622. Theoretical studies and analyses of observations of both visual and spectroscopic binaries.

ATY 644—Visual and Spectroscopic Binary Stars 2. 3 credits
Prerequisite: ATY 643. Continuation of ATY 643.

ATY 645—Eclipsing Binary Stars 1. 3 credits
Prerequisites: ATY 605, ATY 622. Theoretical studies and analyses of observations of eclipsing variables.

ATY 646—Eclipsing Binary Stars 2. 3 credits
Prerequisite: ATY 645. Continuation of ATY 645.

ATY 651—Variable Stars. 3 credits
Prerequisite: ATY 317. An overall picture of the different types of variable stars. Classification, light and spectral changes, population distribution, physical processes causing variability, the place of variables in stellar evolution. Use of variable stars in galactic and extragalactic studies.

ATY 680—Seminar in Modern Astronomy. 1 credit
Recent developments in theoretical and observational astronomy and astrophysics. May be repeated with change of content up to a maximum of 9 credits.

ATY 690—Individual Work. 1 to 5 credits
Supervised study or research in areas not covered by other graduate courses. May be repeated with change of content up to a maximum of 10 credits.

ATY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

ATY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

ATY 699—Master's Research. 1 to 17 credits

ATY 741—Close Binary Stars. 3 credits
Prerequisite: ATY 642. Role of close binaries in stellar evolution. Non-periodic phenomena, mass loss and exchange, novae and nova-like variables, period changes.

ATY 799—Doctoral Research. 1 to 17 credits

BIOCHEMISTRY

GRADUATE FACULTY 1970-71

Cerutti, P. A., *Acting Chairman;* Allen, C. M., Jr.; Chun, P. W.; Fisher, W. R.; Fried, M.; Gurin, S.; O'Brien, T. W.; Rennert, O. M.; Roberts, R. M.; Sander, E. G.

Graduate Coordinator: E. G. SANDER

Prerequisites: Since biochemistry is a multidisciplinary field, the undergraduate major may be in related biological and physical sciences. Required courses include general, organic, quantitative, and physical chemistry and at least 8 credits in physics and in biology. Calculus is recommended. Prebaccalaureate courses in biochemistry are not accredited for the graduate program. Any deficiency in the prerequisites must be satisfied as soon as possible after entering Graduate School.

Doctoral candidates are required to take a core of biochemistry courses which include BCH 601, BCH 602, BCH 603, BCH 615, BCH 616, and BCH 617. Depending upon the interests and background of the student, additional courses are recommended from the following list: BCH 578, BCH 605, BCH 612, BCH 613, BCH 614, and BCH 618. The course of graduate study for doctoral candidates also includes advanced organic and physical chemistry, physiology, microbiology, and genetics.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

BCH 511—BIOCHEMISTRY 1. 4 credits
BCH 512—BIOCHEMISTRY 2. 4 credits
BCH 513—BIOCHEMISTRY LABORATORY. 2 credits
BCH 578—CHEMISTRY OF BIOLOGICAL MOLECULES. 4 credits

GRADUATE COURSES

BCH 601—BIOCHEMISTRY 1. 3 credits
Prerequisite: Organic chemistry. Corequisites: Physical chemistry, BCH 605 (except by special arrangement). Structure, function, and metabolism of cellular constituents. Structure, biosynthesis, and function of macromolecules; bioenergetics; enzyme mechanisms; intermediary metabolism; transport processes; biological control mechanisms.

BCH 602—BIOCHEMISTRY 2. 3 credits
Continuation of BCH 601.

BCH 603—BIOCHEMISTRY 3. 3 credits
Continuation of BCH 602.

BCH 605—LABORATORY METHODS OF BIOCHEMISTRY 1. 2 credits
Corequisite: BCH 601. Laboratory methods, including colorimetry, spectrophotometry, chromatography, cellular fractionation, and techniques of enzymology. Experiments in intermediary metabolism and introduction to isotopic methods.

BCH 612—PHYSICAL BIOCHEMISTRY. 4 credits
Prerequisites: BCH 601, BCH 602, BCH 603, BCH 605; physical chemistry (may be taken concurrently with permission). Physical chemistry and molecular structure of proteins, nucleic acids, enzymes, and metabolites. Biochemical methods, tracer techniques, and bioenergetics.

BCH 613—INFORMATIONAL MACROMOLECULES. 4 credits
Prerequisites: BCH 601, BCH 602, BCH 603, BCH 605. Chemical and physicochemical characteristics of the molecules concerned with heredity, gene replication and mutation, and of their biosynthesis and function.

BCH 614—Bioenergetics and Enzyme Mechanisms. 4 credits
Prerequisites: BCH 601, BCH 602, BCH 603, BCH 605. Mechanisms of enzyme action and the energy transformations occurring in biological systems.

BCH 615—Research Methods in Biochemistry. 2 to 6 credits
Prerequisites: BCH 601, BCH 602, BCH 603, BCH 605. Only by special arrangement. Biochemical research in which the student refines his research techniques in physical biochemistry, intermediary metabolism, and radioisotopes under supervision of a staff member. May be repeated with change of content up to a maximum of 12 credits.

BCH 616—Biochemistry Seminar. 1 credit
Required of graduate students in biochemistry; open to others by special arrangement. Research reports and discussions of current research literature given by the departmental staff, invited speakers, and graduate students.

BCH 617—Special Topics in Biochemistry. 2 credits
Prerequisite or corequisite: BCH 612 or BCH 613 or BCH 614. Supervised study in publications on biochemistry, with informal weekly conferences and reports. May be repeated with change of content up to a maximum of 6 credits.

BCH 618—Biochemistry of Cell Organelles. 4 credits
Prerequisites: Graduate course in Biochemistry or consent of instructor. Biochemistry of nuclei, ribosomes, mitochondria, chloroplasts, Golgi bodies, lyosomes, cell walls, and membranes; compartmentation and integrated cellular function.

BCH 699—Master's Research. 1 to 17 credits

BCH 799—Doctoral Research. 1 to 17 credits

BOTANY

GRADUATE FACULTY 1970-71

Shanor, L., *Chairman*; Aldrich, H. C.; Anthony, D. S.; Davis, J. S.; Ford, E. S.; Fritz, G. J.; Griffin, D. G. III; Griffith, M. M.; Humphreys, T. E.; Kimbrough, J. W.; Lugo, A. E.; Mullins, J. T.; Smith, R. C.; Stanley, R. G.; Vasil, I. K.; Ward, D. B.

Graduate Coordinator: L. Shanor

The Department of Botany offers graduate work leading to the degrees of Master of Science, Master of Agriculture, Master of Science in Teaching, and Doctor of Philosophy.

For admission to graduate standing a student should present credits equivalent to those required of undergraduate majors in the department. Undergraduate major requirements include: 36 credits in botany, a course with laboratory in genetics, mathematics through differential calculus, one year of college physics, and chemistry through organic. Those admitted without full equivalents of an undergraduate major will be required to make up deficiencies by passing appropriate courses early in their graduate programs. A reading knowledge of a foreign language and credit for basic courses in zoology and bacteriology are desirable. The program of graduate study for each student will be determined by a supervisory committee.

For advisory purposes all graduate students will be given an examination covering the broad general field of botany by the department during or soon after their first quarter of residence. The results of this examination will be used by the supervisory committee in planning the student's program. Each student pursuing the Ph.D. degree will be required to pass a written departmental examination on designated major areas in botany prior to the qualifying examination.

There are, in addition to the facilities of the department for graduate work, the following special resources that may be utilized in support of graduate student training and research: (1) the Florida Agricultural Experiment Station and its branch stations, (2) the specialized facilities for radiation biology in the Nuclear Sciences Building, (3) the Marine Sciences Center on the Gulf of Mexico for studies in estuarine and marine habitats, (4) the resources of the Welaka Conservation Reserve, and (5) the Center for Tropical Agriculture which can support studies in tropical and subtropical areas.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

BTY 500—Plant Geography. 4 credits
BTY 501—Plant Ecology. 5 credits
BTY 515—Intermediate Plant Physiology. 5 credits
BTY 521—Introductory Mycology. 5 credits
BTY 522—Phycology. 5 credits
BTY 523—Mosses and Liverworts. 5 credits
BTY 524—Lower Vascular Plants. 3 credits
BTY 532—Plant Anatomy. 5 credits
BTY 542—Taxonomy of Seed Plants. 5 credits
BTY 551—Cytology. 5 credits

GRADUATE COURSES

BTY 601—Vegetation of Florida. 5 credits
Prerequisite: BTY 501. The major communities of Florida in relation to environmental factors. Phytosociological techniques of vegetation analysis applied during visits to selected community types.

BTY 602—Ecology of Aquatic Plants. 5 credits
Prerequisite: BTY 501. The role of plants in aquatic ecosystems. Field trips emphasize the flow of energy and systems structure.

BTY 604—Vegetation of the Tropics. 4 credits
Prerequisite: BTY 501. Tropical vegetation, principles of tropical ecology, and their relation to man.

BTY 605—Tropical Biology: An Ecological Approach. 12 credits
Identical with BLY 605 and ZY 605. Intensive field study of ecological concepts in tropical environments. Eight weeks in different principal kinds of tropical environments. Offered Summer Quarter in Costa Rica as part of the program of the Organization for Tropical Studies.

BTY 607—Advanced Tropical Botany. 12 credits
Identical with BLY 607. Prerequisites: BTY 310; BTY 501 or BTY 542. Limit: 10 participants. Offered Summer Quarter in Costa Rica as a part of the program of the Organization for Tropical Studies. Topics are changed each year.

BTY 611—Biochemistry of Trees. 3 credits
Identical with FY 621. Prerequisite: BCH 403. Metabolic processes and constituents associated with tree growth, reproduction, formation of wood, terpene, and other natural products. Formation of important forest tree chemicals.

BTY 615—Plant Growth and Development. 3 credits
Prerequisite: BTY 515. Ways in which environmental factors influence plant growth and development.

BTY 616—Plant Nutrition. 2 credits
Prerequisite: BTY 515. Plant nutrition, including essentiality of elements, absorption of ions, utilization and role of nutrients, redistribution of minerals in plants, and water metabolism.

BTY 617—Plant Metabolism. 3 credits
Prerequisites: BTY 515, BCH 402. Metabolism of carbohydrates, fats, and nitrogen compounds in higher plants; cell structure as related to metabolism; metabolic control mechanisms.

BTY 618—Radiation and Plant Growth. 3 credits
Prerequisite: BTY 515. Effects of radiant energy on the physiology of plants. Generation, control and measurement of radiant energy; photosynthesis; phototropism; photoperiodism; effect of the color of light; ionizing radiation.

BTY 621—Advanced Mycology 1. 4 credits
Identical with PT 631. Prerequisite: BTY 521. First part of a three-course sequence designed for students whose major or minor is mycology, botany, or plant pathology. Morphology and taxonomy of fungi and identification of specimens. Basidiomycetes and fungi imperfecti. Field work required.

BTY 622—Advanced Mycology 2. 4 credits
Identical with PT 632. Prerequisite: BTY 621. Myxomycetes and phycomycetes. Continuation of BTY 621.

BTY 623—Advanced Mycology 3. 4 credits
Identical with PT 633. Prerequisite: BTY 622. Ascomycetes and lichens. Continuation of BTY 622.

BTY 624—Fungal Genetics. 5 credits
Comparative genetics of mating type and sexual development, chromosome mapping, polyploidy, gene structure and function, and pathogenicity of selected fungi.

BTY 625—Fungal Physiology. 5 credits
Comparative physiology of growth, development, metabolism, and reproduction of selected fungi.

BTY 631—Developmental Morphology of Seed Plants. 5 credits
Prerequisites: BTY 532, BTY 542. Developmental morphology of vegetative and reproductive organs of fossil and modern seed plants, emphasizing form and reproduction from phyletic, experimental, and developmental viewpoints.

BTY 632—Techniques in Developmental Botany. 3 credits
Prerequisite: BTY 532. Experiments and techniques for the elucidation and demonstration of morphogenetic phenomena in plants, and readings from current literature.

BTY 642—Advanced Taxonomy. 3 credits

Prerequisite: BTY 542. Problems in the classification of vascular plants. Published taxonomic studies reviewed as demonstration of techniques and principles involved in classification; intensive individual work required in field and herbarium application of procedures.

BTY 653—Electron Microscopy of Biological Materials. 2 credits

Prerequisite: BTY 551 or ZY 551 and consent of instructor. Use of the electron microscope, including fixation, embedding, sectioning, freeze-etching, negative staining, and use of the vacuum evaporator and electron microscope.

BTY 654—Laboratory in Electron Microscopy. 2 credits

Prerequisites: BTY 551 or ZY 551; BTY 653 or concurrent registration in BTY 653 and consent of instructor. Laboratory training in use of electron microscopes, ultramicrotomes, vacuum evaporators, and freeze-etch machines.

BTY 655—Plant Cytology. 5 credits

Prerequisite: BTY 551. Fundamental structures of plant cells, their functions, reproduction and relation to inheritance; recent research and techniques.

BTY 656—Cytochemistry. 4 credits

Cellular organization, cell function, and cytochemical technique.

BTY 690—Problems in Botany. 2 to 5 credits

Prerequisites: Approval of department chairman and consent of instructor. Problems in one or more of the following fields of botany: cytology, ecology, morphology and anatomy, physiology, radiation biology, and taxonomy. May be repeated with change of content up to a maximum of 9 credits.

BTY 692—Botany Seminar. 1 credit

Graduate majors expected to participate regularly. They register for 1 credit during the last quarter of a degree program. Not available for graduate minor credit except by special permission of department chairman.

BTY 695—Topics in Botany. 2 credits

Topics include plant biophysics, growth regulators, chromatography, water relations, ultrastructure cytology, plant morphogenesis, and biosystematics.

BTY 696—Topics in Genetics. 2 to 4 credits

Identical with AL 664, AY 664, DY 664, PY 664, ZY 664. See AY 664. May be repeated with change of content up to a maximum of 12 credits.

BTY 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

BTY 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

BTY 699—Master's Research. 1 to 17 credits

BTY 799—Doctoral Research. 1 to 17 credits

BUILDING CONSTRUCTION

GRADUATE FACULTY 1970-71

Johnson, L. A., *Chairman*; Bristor, J. D.; Eppes, B. G.; Halperin, D. A.; Holland, H. F.; Manning, J. H.; Prugh, B. J.; Williamson, H. D.

Graduate Coordinator: J. H. Manning

Courses are offered leading to the degrees of Master of Science in Building

Construction and Master of Building Construction. Specialization may be in the areas related to construction such as materials, techniques, industrialized building and systems, management, research, and structural concepts.

There is no foreign language requirement. The objectives of this graduate program are to: (1) provide advanced construction courses, (2) provide opportunity for study of construction problems and subjects in depth, (3) broaden the student's base of knowledge and understanding in the construction areas, (4) prepare for teaching, and (5) prepare for research.

Holders of the four-year undergraduate degree in building construction or its equivalent in related fields may normally complete the requirement for the master's degree in one academic year (three quarters) as full-time students. "Equivalent in related fields" should include studies in construction materials and methods, structures, and management. Students with undergraduate degrees but with deficiencies in these related fields may need longer residence for the master's degree, as they will be required to take specified basic courses to provide foundation for advanced courses.

The department reserves the right to retain student work for purposes of record, exhibition, or instruction.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

BCN 601—Advanced Structures. 4 credits
BCN 502—Construction Planning and Control. 4 credits
BCN 503—Advanced Construction Techniques. 4 credits
BCN 504—Construction Cost Analysis. 4 credits
BCN 505—Special Studies in Construction. 3 to 9 credits

GRADUATE COURSES

BCN 601—Building Construction. 5 to 10 credits
Studies in building technology or in specialized areas of the building construction field selected by the student and approved by the faculty. May be repeated with change of content up to a maximum of 10 credits.

BCN 602—Building Construction. 5 to 10 credits
Continuation of BCN 601. May be repeated with change of content up to a maximum of 10 credits.

BCN 603—Building Research. 5 to 10 credits
Investigation of a selected problem in the building construction field designed to make a significant contribution to present knowledge and practices in that field. May be repeated with change of content up to a maximum of 10 credits.

BCN 604—Building Research. 5 to 10 credits
Continuation of BCN 603. May be repeated with change of content up to a maximum of 10 credits.

BCN 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

BCN 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

BCN 699—Master's Research. 1 to 17 credits

BUSINESS ADMINISTRATION—GENERAL

For admission to courses listed below, the student must have been admitted to the Graduate School and normally should have had undergraduate courses in fields pertinent to the graduate courses selected. Where necessary, special arrangements may be made with the approval of the dean.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

BS 540—Computer Based Business Management. 4 credits

BS 591—Mathematical Methods and Their Application to Business and Economic Analysis. 5 credits

GRADUATE COURSES

BS 610—Managerial Accounting. 4 credits

Prerequisites: ATG 201, ATG 203 or ATG 204; or ATG 510. Designed for M.B.A. students. Periodic income measurement; relation of accounting techniques to control of business operations; effects of federal income taxes on management decisions.

BS 664—Managerial Statistics. 4 credits

Utilization of statistical methods in business decision making. Statistical inference as an approach to solving business problems.

BS 671—Human Relations in Business. 4 credits

Relationship between the individual business administrator and his superiors, the employees whom he supervises, and his associates at his own level in the company organization.

BS 679—Business Policy. 4 credits

Cutting across the whole field of business administration, this course approaches business policy making and administration from the top management point of view. Uses the case method to integrate knowledge the student has acquired in specialized courses. Required of all candidates for the M.B.A. degree.

BS 690—Business Research and Reports. 2 credits

Discovery and utilization of available information relating to individual business problems. Several reports required for development of skills in presentation and interpretation of research findings.

BS 691—Business Research and Reports. 2 credits

Continuation of BS 690. Both courses must be completed to receive credit. Required of all candidates for the M.B.A. degree.

BS 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

BS 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

BS 799—Doctoral Research. 1 to 17 credits

CELLULAR AND MOLECULAR BIOLOGY

GRADUATE FACULTY 1970-71

BERNER, L., *Acting Director of the Division of Biological Sciences*; O'BRIEN, T. W., *Chairman*; ACHEY, P. M.; ALDRICH, H. C.; BILLEN, D.; BLEIWEIS, A. S.; BROOKBANK, J. W.; BYVOET, P.; CRAMER, J. W.; ELLIOTT, P. R.; FELDHERR, C. M.; FREGLY, M. J.; FRIED, M.; GREGG, J. H.; LARKIN, A. R. S.; MANS, R. J.; MOSCOVICI, C.; NASSER, DeL. S.; PREVIC, E. P.; VASIL, I. K.

Graduate Coordinator: T. W. O'BRIEN

The degree of Doctor of Philosophy with a specialty in cellular and molecular biology is offered through the Departments of Neuroscience, Botany, Microbiology, and Zoology. The teaching of graduate courses and supervision of graduate students is conducted by the faculty listed above drawn from Microbiology, Botany, Zoology, Neuroscience, Biochemistry, Medicine, Immunology and Medical Microbiology, and Pathology.

Undergraduate Preparation: In addition to a bachelor's or master's degree in one of the natural sciences, the undergraduate equivalent of the following University of Florida courses is required: mathematics through MS 303 (Analytical Geometry and Calculus) and STA 320 (Introduction to Statistics), physics through PS 217 (1 year), chemistry through Organic and Physical (CY 373) (CY 342), biology including ZY 570 and ZY 571 (Cell Physiology) and BTY 551 or ZY 551 (Cytology).

Graduate programs in line with the requirements of individual students will be developed by members of the faculty of cellular and molecular biology and approved by the faculty as well as by the department in which the student will major for the degree.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

BLY 560—RADIATION EFFECTS AND RADIATION BIOLOGY. 5 credits
BLY 565—RADIOISOTOPE THEORY AND TECHNIQUES. 5 credits

GRADUATE COURSES

BLY 601—CELLULAR AND MOLECULAR BIOLOGY. 3 credits
An interdisciplinary course presented by the several departments of the above colleges to orient the student broadly in the cellular and molecular aspects of biology.

BLY 602—ADVANCES IN CELLULAR AND MOLECULAR BIOLOGY 1. 2 credits
Identical with MED 695. The relationship between cell structure: 1) organization of chromosomes, RNA synthesis, and translation of the genetic code into functional entities; 2) organization of cellular membranes; 3) ultrastructure, function, and biosynthesis of sub-cellular organelles; 4) regulatory mechanisms of the cell; correlation of *in vitro* and *in vivo* experiments.

BLY 603—ADVANCES IN CELLULAR AND MOLECULAR BIOLOGY 2. 2 credits

Identical with MED 696. Prerequisite: BLY 602. The relationship between cell structure: 1) organization of chromosomes, RNA synthesis, and translation of the genetic code into functional entities; 2) organization of cellular membranes; 3) ultrastructure, function and biosynthesis of sub-cellular organelles; 4) regulatory mechanisms of the cell; correlation of *in vitro* and *in vivo* experiments.

BLY 605—Tropical Biology: An Ecological Approach. 12 credits

Identical with BTY 605 and ZY 605. Field study of ecological concepts in tropical environments. Offered Summer Quarter in Costa Rica as part of the program of the Organization for Tropical Studies.

BLY 607—Advanced Tropical Botany. 12 credits

Identical with BTY 607. Prerequisites: BTY 310; BTY 501 or BTY 542. Topics changed each year. Topics have been tropical forest ecology, morphology and biology of tropical monocotyledons, biology of tropical Epiphytes, and biology of tropical grasses and tropical Pteridophytes. Limit: 10 participants. Offered Summer Quarter in Costa Rica as part of program of the Organization for Tropical Studies.

BLY 610—Advanced Tropical Zoology. 12 credits

Identical with ZY 610. Vertebrate or invertebrate group selected as basis for studies of ecological systems in the tropics. Effects of elevation and temperatures on populations, successions, microhabitat, distribution, predation, evolution, and other aspects. Offered Winter and Summer Quarters in Costa Rica as part of the program of the Organization for Tropical Studies.

BLY 618—Biochemistry of Cell Organelles. 4 credits

Identical with BCH 618. Prerequisites: Graduate course in Biochemistry or consent of instructor. Biochemistry of nuclei, ribosomes, mitochondria, chloroplasts, Golgi bodies, lysosomes, cell walls and membranes; compartmentation and integrated cellular function.

BLY 660—Special Topics in Radiation Biology. 5 credits

Prerequisites: BLY 560; one year each of college physics, mathematics, and biology or botany; chemistry through organic. Readings and research on the biological effects of radiation with emphasis on cellular effects and mechanisms.

CHEMICAL ENGINEERING

GRADUATE FACULTY 1970-71

Walker, R. D., Jr., *Acting Chairman*; Bennett, R. B.; Block, S. S.; Brown, H. C.; Fahien, R. W.; Gordon, R. J.; Gubbins, K. E.; Johns, L. E.; Kirmse, D. W.; May, F. P.; Nolan, W. J.; O'Connell, J. P.; Reed, T. M.; Schweyer, H. E.; Shah, D. O.; Smutz, M.; Tyner, M.; Westerberg, A. W.

Graduate Coordinator: J. P. O'Connell

Graduate work for the Ph.D., M.E., and M.S.E. degrees in chemical engineering emphasizes these areas: (1) Chemical Engineering Science—transport phenomena, fluid dynamics, thermodynamics, kinetics, microstructure of matter, and materials science; (2) Chemical Engineering Systems—chemical reaction engineering, process control, process dynamics, optimization, separations processes; and (3) Interdisciplinary Chemical Engineering—energy conversion and

fuel cells, polymer science, microelectronics, process economics, biofluid mechanics, and bioengineering.

Beyond the Graduate School requirements, admission to graduate work in chemical engineering depends upon the qualifications of the student, whose record and recommendations are carefully and individually studied. During registration week each graduate student registering for the first time is counseled to develop an initial study program best suited for his needs. The results of a brief examination covering the field of chemical engineering are also utilized by the Graduate Committee to guide the student. As a consequence, his program may include some undergraduate courses, if needed, to prepare him for graduate course work.

It is expected that all new graduate students will become proficient in computer programming during their first quarter on campus.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

CHE 503—Mathematical Methods in Chemical Engineering. 3 credits

CHE 512—Process Systems Laboratory. 3 credits

CHE 540—Multidimensional Transport Phenomena. 3 credits

CHE 547—Electrochemical Engineering. 3 credits

CHE 551—Polymeric Materials. 3 credits

CHE 573—Organic Chemical Processing. 3 credits

CHE 576—Process Economics. 3 credits

GRADUATE COURSES

CHE 601—Graduate Seminar. 1 credit

Required regularly of all graduate students.

CHE 602—Chemical Engineering Calculations. 2 credits

Calculation techniques used in advanced engineering problems.

CHE 603—Models and Methods. 3 credits

Prerequisite: CHE 602. Mathematical modeling and application to engineering problems of ordinary and partial differential equations, operational calculus, digital and analog computation techniques, complex variables, and integral equations.

CHE 604—Multidimensional and Discrete Systems. 3 credits

Applications of the mathematics of multidimensional and discrete systems to engineering problems. Matrix methods. Calculus of finite differences. Linear programming.

CHE 605—Applied Field Theory. 3 credits

Prerequisite: Consent of instructor. Field equations of heat, mass, and momentum transport, and electromagnetic theory in orthogonal and nonorthogonal Euclidean and non-Euclidean geometries. Covariant and convective differentiation of tensors. Surface geometries. Applications of Laplace, Helmholtz, diffusion, and wave equations.

CHE 606—Applied Statistics and Probabilistic Systems. 3 credits

Prerequisite: CHE 603. Applications of random variables and probability distributions; stochastic models, Monte Carlo techniques; statistical inference, sampling distributions, tests of significance, and experimental design.

CHE 610—Process Dynamics 1. 3 credits

Dynamics and control of chemical processing systems with emphasis on the dynamics of the unit operations and chemical reactions. Analog simulation of chemical processing systems.

CHE 611—Process Dynamics 2. 3 credits

Continuation of CHE 610.

CHE 614—Computer Control of Processes. 3 credits

Prerequisite: CHE 616. Application of computers to control of chemical processes, including the practical work involved in planning, organizing, managing, and executing a computer control project.

CHE 615—Optimization Techniques. 3 credits

Prerequisite: CHE 503 or CHE 603. Introduction to optimization techniques used in chemical process operations, process control, and systems engineering.

CHE 616—Process Systems Optimization. 3 credits

Prerequisite: CHE 615. Optimization of chemical processes and systems, with particular emphasis on dynamic programming and the maximum principle.

CHE 617—Design Techniques for Process Systems. 3 credits

Computer aided process simulation and design. Decomposition techniques for system synthesis, analysis and optimization.

CHE 621—Chemical Engineering Kinetics. 3 credits

Chemical kinetics useful in the design of chemical reactors; molecular collision theory, transition theory, homogeneous and heterogeneous reactions in gas, liquid, and solid phase with energy and mass transfer.

CHE 622—Reactor Design and Optimization. 3 credits

Application of principle of chemical kinetics to the design of batch, tubular flow, and tank flow reactors for optimum conditions.

CHE 626—Transport Properties and Irreversible Thermodynamics. 3 credits

Prerequisites: CHE 631; CHE 632 or CHE 633. Molecular models and statistical mechanical methods useful in the prediction and correlation of viscosity, diffusivity and thermal conductivity of fluids. Boltzmann equation, radial distribution function, cell models, absolute rate theory, corresponding states principle.

CHE 631—Thermodynamics of Reaction and Phase Equilibria. 3 credits

Methods for treating chemical and phase equilibria in multicomponent systems through the application of thermodynamics and molecular theory.

CHE 632—Applied Statistical Mechanics. 3 credits

Methods of wave mechanics and statistical mechanics in engineering problems.

CHE 633—Statistical Thermodynamics. 3 credits

Use of statistical mechanics to describe, predict, and correlate thermodynamic properties of compounds and mixtures.

CHE 640—Introduction to Transport Phenomena. 3 credits

Prerequisite: MS 305. Basic equations of change for heat, mass, and momentum. Applications of conservation and flux equations for laminar and turbulent flow. Radiation, transfer coefficients, macroscopic balances.

CHE 641—Transport Phenomena. 4 credits

Prerequisite: CHE 540 or CHE 640. Rigorous development of differential conservation equations and macroscopic balances. Non-Newtonian fluid dynamics, turbulence, boundary layer theory, transfer coefficients. Applications.

CHE 642—Interfacial Transport Phenomena. 3 credits
Prerequisite: CHE 641. Transport of heat, mass, and momentum at interfaces. Heat and mass transfer coefficients, drag coefficient, and friction factor. Boundary layer theory.

CHE 643—Turbulent Transport Phenomena. 3 credits
Prerequisite: CHE 641. Statistical theory of turbulence; correlation coefficients, energy spectra, isotrophy and homogeneity, eddy diffusivity, and viscosity tensors. Boundary layer theory.

CHE 644—Advanced Transport Phenomena. 3 credits
Prerequisite: CHE 641. Continuation of CHE 641.

CHE 645—Rheology. 3 credits
Analysis and characterization of rheological systems.

CHE 646—Non-Newtonian Fluid Dynamics. 3 credits
Prerequisite: CHE 645. Constitutive equations for non-Newtonian fluids (including viscoelastic substances) such as polymers, plastics, paints, and slurries.

CHE 647—Chemical Energy Conversion. 3 credits
Prerequisite: CHE 540 or CHE 640. Principles of thermodynamics and transport phenomena applied to the analysis and design of chemical energy conversion devices.

CHE 648—Particulate Systems. 3 credits
Dynamics of fluid-solid, fluid-fluid, and biological systems; generalized population balances, macroscopic particle balance, kinetics of particle growth, birth and death functions, particle size determination. Crystallization, filtration, aerosols, entrainment, free molecule flow, and fluidized reactors.

CHE 649—Applied Fluid Dynamics. 3 credits
Basic equations of fluid dynamics applied to chemical engineering problems in fluid-solid and fluid-fluid systems; low Reynold's number and particulate system fluid dynamics; physiochemical hydrodynamics.

CHE 650—Engineering Properties of Organic Materials. 3 credits
Prerequisite: CHE 551. Theoretical studies in molecular science. Correlation of composition, microstructure, and morphology of organic materials with macroscopic engineering properties.

CHE 651—Macromolecular Materials. 3 credits
Formation, structure, and physical and chemical properties of macromolecules. Polymerization and processing methods. Commercial techniques in forming. Applications.

CHE 662—Mass Transfer Operations. 3 credits
Process design of equipment for mass transfer operations based on performance and economic optima.

CHE 663—Heat Transfer Operations. 3 credits
Process design of equipment for heat transfer operation based on performance and economic optima.

CHE 665—Stagewise Separations Processes. 3 credits
Theory, design, and evaluation of staged separation processes such as distillation columns, extractors, and absorbers. Multicomponent-multistage distributions using rigorous digital computer computational methods. Real-time modeling for process automation.

CHE 671—Process Engineering. 3 credits
Application of chemical engineering operations and processing to industrial operations, such as petroleum refinery, manufacture of phosphates and fertilizers, and paper pulp processing.

CHE 672—Process Equipment Design. 3 credits

Unit operations with emphasis on design of equipment to perform the service required, considering capacity, materials, equipment, and economics.

CHE 673—Process and Plant Design. 3 credits

Techniques in the design of various complex chemical processes and plants.

CHE 676—Process Economy Analysis. 3 credits

Prerequisite: CHE 576. Economics in design and operation of chemical engineering equipment. Analysis for decision under conditions of certainty and uncertainty with applications of queuing, Monte Carlo, Markov processes, and geometric and dynamic programming.

CHE 677—Biochemical Engineering. 3 credits

Physical and chemical peculiarities of living organisms and their products. Material and energy transfer in living systems, unit operations in biological processes, and industrial biochemical engineering processes.

CHE 678—Interfacial Phenomena 1. 3 credits

Prerequisites: CY 204, PS 213. Air-liquid and liquid-liquid interfaces; surface-active molecules, adsorption at interfaces, foams, micro- and macro-emulsions, retardation of evaporation and damping of waves by films, surface chemistry of biological systems.

CHE 679—Interfacial Phenomena 2. 3 credits

Prerequisites: CY 204, PS 213. Solid-gas, solid-liquid, solid-solid interfaces: Adsorption of gases and surface-active molecules on metal surfaces, contact angle and spreading of liquids, wetting and dewetting, lubrication, biolubrication, flotation, adhesion, biological applications of surfaces.

CHE 680—Advanced Seminar in Chemical Engineering. 2 credits

Research and current literature in chemical engineering. May be repeated with change of content up to a maximum of 6 credits.

CHE 681—Advanced Seminar in Process Control. 2 credits

Prerequisites: CHE 610, CHE 611. Research and current problems in process control. May be repeated with change of content up to a maximum of 6 credits.

CHE 682—Advanced Seminar in Transport Phenomena. 2 credits

Prerequisite: CHE 641. Research and current literature in transport phenomena. May be repeated with change of content up to a maximum of 6 credits.

CHE 683—Advanced Seminar in Thermodynamics. 2 credits

Prerequisites: CHE 631; CHE 632 or CHE 633. Research and current literature in thermodynamics. May be repeated with change of content up to a maximum of 6 credits.

CHE 685—Advances in Separations Processes. 3 credits

Prerequisite: CHE 665. Separations processes such as thermal diffusion, molecular distillation, fractional crystallization, adsorption fractionation, and zone refining.

CHE 686—Advances in Process Systems Engineering. 3 credits

Prerequisite: CHE 617.

CHE 687—Advances in Numerical and Analytical Computation. 3 credits

Prerequisites: CHE 603, CHE 604. Numerical and analytical techniques such as iterative matrix methods, hybrid computation, direct vector methods, functional analysis, and adaptive models.

CHE 690—Special Topics in Chemical Engineering 1. 1 to 6 credits

Separations processes, reactor design, applied molecular and kinetic theory, thermodynamics, particulate systems, properties of chemical substances, transport

phenomena, non-Newtonian fluid dynamics, turbulence, applied mathematics, computer science, biochemical and electrochemical engineering. CHE 690, CHE 691, CHE 692 may be repeated with change of content, but no more than 12 credits can be received for any combination of these three.

CHE 691—Special Topics in Chemical Engineering 2. 1 to 6 credits
Continuation of CHE 690.

CHE 692—Special Topics in Chemical Engineering 3. 1 to 6 credits
Continuation of CHE 691.

CHE 696—Individual Work. 1 to 9 credits
Individual engineering projects suitable for Master of Engineering degree.

CHE 699—Master's Research. 1 to 17 credits

CHE 799—Doctoral Research. 1 to 17 credits

CHEMISTRY

GRADUATE FACULTY 1970-71

Jones, W. M., *Chairman;* Bates, R. G.; Battiste, M. A.; Baxter, J. F.; Brey, W. S., Jr.; Brown, H. C.; Butler, G. B.; Colgate, S. O.; Cram, S. P.; Deyrup, J. A.; Dolbier, W. R., Jr.; Dresdner, R. D.; Gabby, E. J.; Hanrahan, R. J.; Helling, J. F.; Löwdin, P. O.; Micha, D. A.; Muga, M. L.; Muschlitz, E. E., Jr.; Myers, G. H.; Ohrn, N. Y.; Palenik, G. J.; Person, W. B.; Reid, C. E.; Ryschkewitsch, G. E.; Schmidt, G. M.; Sisler, H. H.; Slater, J. C.; Stearns, T. W.; Stoufer, R. C.; Tarrant, P.; Vala, M. T.; Weltner, W., Jr.; Winefordner, J. D.; Zoltewicz, J. A.

Graduate Coordinator: W. S. Brey, Jr.

New graduate students should have adequate undergraduate training in inorganic, analytical, organic, and physical chemistry. Normally this will include as a minimum a year of general chemistry which may include qualitative analysis, one quarter of quantitative analysis, one year of organic chemistry, one year of physical chemistry, and one quarter of advanced inorganic chemistry. Additional courses in instrumental analysis, advanced physicial and organic chemistry are desirable. Deficiencies in any of these areas may be corrected during the first year of graduate study. Such deficiencies are determined by a series of placement tests given prior to registration, and the results of these tests are used in planning the student's program.

Courses for the master's degree are chosen in terms of the student's interest with the approval of his supervisory committee. These courses usually include some of those listed in the next paragraph which are the first courses in the indicated fields. The master's degree in chemistry requires a thesis. The degree Master of Science in Teaching is offered with specialization in chemistry.

All doctoral candidates are required to take a series of basic courses in at least three of the four areas of chemistry indicated below unless taking the chemical physics option. The areas and the required courses in each area are as follows: physical chemistry, CY 600, and any course from the sequence

641 through 645; organic chemistry, CY 661; analytical chemistry, CY 635, CY 636 or CY 637; and inorganic chemistry, CY 612.

A chemical physics option is offered for students who will be doing research in areas of physical chemistry which require a strong background in physics. In addition to courses in chemistry, a minimum of 22 credits in 400-level or higher physics courses or a minimum of 12 such credits in physics and 12 in 400-level or higher mathematics courses are required. However, basic chemistry courses need to be taken in only two of the four areas mentioned in the previous paragraph.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

CY 511—Inorganic Chemistry. 4 credits
CY 542—Physical Chemistry. 3 credits
CY 543—Advanced Physical Chemistry Laboratory. 3 credits
CY 545—Chemical Computation. 3 credits
CY 550—Radiochemistry. 3 credits
CY 551—Radiochemistry Laboratory. 2 credits
CY 565—Organic Chemistry. 2 credits
CY 566—Organic Chemistry Laboratory. 3 credits
CY 575—Current Topics in Organic Chemistry. 3 credits
CY 578—Chemistry of Biological Molecules. 4 credits
CY 590—Individual Problems. 2 to 5 credits

GRADUATE COURSES

CY 600—Chemical Bonding and Spectra. 5 credits
Introductory quantum chemistry of atoms and molecules; chemical applications of the theory of symmetry; molecular orbital treatment of simple inorganic and organic molecules; electronic and vibrational spectra and selection rules.

CY 605—Chemistry Colloquium. 1 credit
Topics presented by visiting scientists and local staff members. May be repeated up to a maximum of 6 credits.

CY 610—Inorganic Preparations. 5 credits
Lectures and laboratory experiments showing the reactions and techniques used in the synthesis of inorganic compounds.

CY 612—Advanced Inorganic Chemistry. 4 credits
The crystalline state, energetics in inorganic chemistry, acid-base theories, non-aqueous solvents, kinetics and inorganic reaction mechanisms.

CY 615—Chemistry of the Nonmetals. 3 credits
Prerequisites: CY 600, CY 612. Relation of properties to atomic, molecular, and crystal structures.

CY 616—Chemistry of the Metals. 3 credits
Prerequisites: CY 600, CY 612. Relation of properties to atomic, molecular, and crystal structure.

CY 617—Special Topics in Inorganic Chemistry. 1 to 3 credits
Lectures or conferences pertaining to selected topics of current research interest in inorganic chemistry. May be repeated with change of content up to a maximum of 15 credits.

CY 618—Inorganic Chemistry Seminar. 1 credit
Prerequisite: One graduate course in inorganic chemistry. Presentation of one seminar. Seminar attendance required of graduate majors in inorganic chemistry. May be repeated for credit.

CY 629—Chemical Physics. 3 credits
Identical with PS 629.

CY 635—Separation Methods and Analyses. 4 credits
Principles of gas-liquid chromatography, chromatographic methods of separation, solution equilibria, and nuclear methods of analysis.

CY 636—Spectrochemical Methods of Analysis. 4 credits
Principles of atomic and molecular absorption and emission spectroscopy as applied to qualitative and quantitative analysis.

CY 637—Electrochemistry. 4 credits
Potentials, electrical double layer theory, principles of electrochemical kinetics, analytical applications.

CY 638—Analytical Chemistry Seminar. 1 credit
Prerequisite: One graduate course in analytical chemistry. Presentation of one seminar. Seminar attendance required of graduate majors in the analytical area. May be repeated for credit.

CY 639—Special Topics in Analytical Chemistry. 2 credits
Prerequisite: Two quarters of the CY 630 series. Lectures or conferences covering selected topics of current interest in analytical chemistry. May be repeated with change of content up to a maximum of 12 credits.

CY 640—Physical Chemistry Seminar. 1 credit
Prerequisite: Graduate course in physical chemistry. Presentation of one seminar. Attendance required of graduate majors in physical chemistry. May be repeated up to a maximum of 6 credits.

CY 641—Chemical Thermodynamics. 3 credits
Energetics, properties of ideal and nonideal systems primarily from the standpoint of classical thermodynamics.

CY 642—Kinetic Theory. 3 credits
Prerequisite: CY 641. Classical statistics, the Maxwell-Boltzmann distribution, molecular collision dynamics, elements of transport theory, virial theorem, intermolecular forces.

CY 643—Statistical Thermodynamics. 3 credits
Prerequisite: CY 642. Fundamental principles of statistical thermodynamics with applications to systems of chemical interest.

CY 644—Chemical Kinetics. 4 credits
Prerequisite: One course of graduate physical chemistry. Rates and mechanism of chemical reaction.

CY 645—Introduction to Molecular Spectroscopy. 4 credits
Prerequisite: CY 600. Electronic structure of the atom; spectroscopic selection rules; molecular rotational, and electronic spectra; introduction to group theory.

CY 647—Quantum Theory of Matter 1. 4 credits
Identical with PS 647. Prerequisites: PS 440, MS 501, MS 502, MS 503. Schrödinger's equation, matrix methods, variation and perturbation theory. The hydrogen atom, the self-consistent field. Angular momentum, the vector model of the atom.

CY 648—Quantum Theory of Matter 2. 4 credits
Identical with PS 648. Prerequisite: CY 647. The determinantal method and multiplets. Interaction of radiation and matter. Spinning electron. Thomas-Fermi and Hartree-Fock methods. The hydrogen molecular ion and molecule.

CY 649—Quantum Theory of Matter 3. 4 credits
Identical with PS 649. Prerequisite: CY 648. Diatomic and polyatomic molecules. Group theory and symmetry of molecules. Energy bands in crystals.

CY 650—Special Topics in Physical Chemistry. 1 to 3 credits
Lectures or conferences covering selected topics of current interest in physical chemistry. May be repeated with change of content up to a maximum of 15 credits.

CY 652—The Physical Chemistry of Polymers. 3 credits
Prerequisites: CY 373, CY 451, CY 452, and calculus through differential equations or consent of the instructor. Configuration of polymer chains. Solution properties of polymers and prolyelectrolytes. Solid state properties of polymers.

CY 653—Physical Chemistry of Surfaces. 3 credits
Prerequisite: CY 641. Liquid-gas and solid-gas interface; adsorption and heterogeneous catalysis.

CY 654—Colloids. 2 credits
Methods of preparation and characteristics of colloidal dispersions; optical, kinetic, electrokinetic, and rheological properties of colloidal and macromolecular systems.

CY 655—Elements of Quantum Chemistry. 3 credits
Prerequisite: CY 600. Brief treatment of the Schrödinger equation, followed by a survey of applications to chemical problems.

CY 657—Nuclear Chemistry. 3 credits
Prerequisite: CY 550 or consent of instructor. Radioactivity, nuclear structure, decay processes, nuclear reactions.

CY 658—Radiation Chemistry. 2 credits
Prerequisite: CY 644. Chemical and physical effects caused by ionizing radiations. Kinetics and mechanism of radiation-induced reactions.

CY 659—Photochemistry. 2 credits
Prerequisite: CY 644. Experimental and theoretical aspects of chemical reactions induced by visible and ultraviolet radiation. Fluorescence and chemiluminescence.

CY 660—Organic Preparations. 4 credits
Lectures and laboratory showing the reactions and techniques used in synthesis of organic compounds.

CY 661—Advanced Organic Chemistry. 3 credits
Prerequisites: CY 373, CY 565, CY 566. Advanced organic chemistry intended to present a useful interpretation of descriptive fact and unifying theory.

CY 662—Advanced Organic Chemistry. 3 credits
Continuation of CY 661.

CY 663—Advanced Organic Chemistry. 3 credits
Prerequisite: CY 662. Synthesis of complex organic molecules, with emphasis on recent developments in approaches and methods.

CY 668—Chemistry of High Polymers. 2 credits
Fundamental approach to the chemistry of high polymers, with emphasis on the mechanisms of polymerization reactions and the relationship of physical properties to chemical constitution.

CY 669—High Polymer Chemistry Laboratory. 2 credits
Prerequisite or corequisite: CY 668. Consists of two three-hour laboratories per week or their equivalent. Preparation of representative members of the high polymer family and determination of their physical properties, methods of polymerization, and determination of fundamental polymer properties.

CY 670—Organic Chemistry Seminar. 1 credit
Prerequisites: CY 661, CY 662, CY 663. Presentation of one seminar and seminar attendance required of graduate majors in the organic area. May be repeated for credit.

CY 671—Physical-Organic Chemistry. 2 credits
Theory and application of physical methods in the study of the behavior of organic compounds.

CY 672—Organic Fluorine Chemistry. 3 credits
Preparation and properties of compounds containing fluorine, with particular reference to carbon compounds.

CY 673—Organometallic Compounds. 2 credits
Prerequisite: CY 661 or CY 662. Properties of organometallic compounds, the nature of the carbon-metal bond, compounds of metals in groups 1, 2, 3, and 4, and transition metals.

CY 674—Free Radical Reactions. 2 credits
Prerequisites: CY 661, CY 662, CY 663. Development and correlation of experimental methods, fact and theory of reactions involving organic free radicals.

CY 675—The Chemistry of Heterocyclic Compounds. 2 credits
Prerequisites: CY 661, CY 662, CY 663.

CY 676—Organic Reaction Mechanisms. 3 credits
Prerequisites: CY 661, CY 662, CY 663. Ionic reaction mechanisms with emphasis on transition state theory, electronic effects, and stereochemical consequences of these reactions.

CY 677—Special Topics in Organic Chemistry. 2 credits
Prerequisites: CY 661, CY 662. The chemistry of selected types of organic compounds, such as alkaloids, carbohydrates, natural products, steroids.

CY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

CY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

CY 699—Master's Research. 1 to 17 credits

CY 756—Theory of Atomic and Molecular Structure 1. 3 credits
Identical with PS 756. Prerequisite: CY 649 or PS 649. First half of CY 756, 757. Mathematical techniques used in atomic, molecular, and solid-state theory. The one-electron approximation and the general quantum-mechanical many-body problem. Selected advanced topics.

CY 757—Theory of Atomic and Molecular Structure 2. 3 credits
Identical with PS 757. Continuation of CY 756.

CY 799—Doctoral Research. 1 to 17 credits

CIVIL ENGINEERING

GRADUATE FACULTY 1970-71

SCHAUB, J. H., *Chairman;* CHRISTENSEN, B. A.; COLLIER, C. A.; DEAN, R. G.; GRANTHAM, W. J., JR.; JEN, Y.; KLUGE, R. W.; PETRYK, S.; RUTH, B. E.; SAWYER, H. A., JR.; SCHMERTMANN, J. H.; SELF, M. W.; SPANGLER, B. D.; ZIMPFER, W. H.

Graduate Coordinator: J. H. SCHAUB

For the degrees of Master of Science in Engineering and Master of Engineering, graduate students may pursue major work in the following areas of civil engineering concentration: construction, hydraulics, soil mechanics and foundations, structures, transportation, or a combination thereof. All resident graduate students will register for CE 691 (Graduate Civil Engineering Seminar) for a minimum of 3 credits at one credit per quarter. This credit is not applicable to the requirement for any degree. A requirement of the Master of Engineering degree is 3 credits of CE 696 (Individual Work) involving preparation of a report of substantial engineering significance. Minor work may be taken in a variety of related and supporting fields of study.

Graduate programs leading to the Ph.D. degree may be established with major areas of study in several fields of interest within the civil engineering profession. These are coastal engineering, hydraulics, structures, soil mechanics, foundation engineering, and transportation. Minor work may be taken in a variety of related and supporting fields of study. The specific program leading to the Ph.D. degree is developed to meet the particular needs and interests of the individual student. The following *Engineering Common Courses* are available for graduate major credit: EGC 541—Tensor Fields and Fluid Dynamics; EGC 621—Surface Hydrology.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

CE 502—CONSTRUCTION PLANNING SCHEDULING.	3 credits
CE 505—CONSTRUCTION CONTRACTS AND SPECIFICATIONS.	3 credits
CE 510—HIGHWAY DESIGN.	3 credits
CE 512—TRANSPORTATION ENGINEERING.	3 credits
CE 513—TRAFFIC ENGINEERING CHARACTERISTICS.	4 credits
CE 520—PROBLEMS IN HYDRAULICS.	3 credits
CE 521—GEOHYDROLOGY.	3 credits
CE 522—OPEN-CHANNEL HYDRAULICS 1.	3 credits
CE 525—HYDRAULIC MOTORS AND PUMPS.	3 credits
CE 560—STRESS-DEFORMATION ANALYSIS OF SOIL MEDIA.	3 credits
CE 561—SOIL EXPLORATION FOR ENGINEERING DESIGN.	3 credits
CE 570—DESIGN IN PRESTRESSED CONCRETE.	3 credits
CE 571—PLANNING AND DESIGN OF INDUSTRIAL BUILDINGS.	3 credits
CE 572—DESIGN OF HIGHWAY BRIDGES.	3 credits

CE 573—Design of Structural Systems. 3 credits
CE 590—Computer Methods in Civil Engineering. 3 credits
CE 591—Civil Engineering Systems. 4 credits

GRADUATE COURSES

CE 609—Special Studies in Transportation Engineering. 1 to 9 credits
Topics in physical planning, design, and construction of transportation systems. May be repeated with a change in content up to a maximum of 9 credits.

CE 610—Advanced Highway Engineering. 3 or 6 credits
Prerequisite: CE 410. Highway soil engineering, behavior of granular and stabilized highway materials, advanced pavement design, highway capacity, and highway planning.

CE 611—Transportation System Operation and Analysis. 4 credits
Prerequisite: CE 512. Capacity, speed, and cost of alternate transportation modes. Analysis and simulation of alternate transportation systems. New systems.

CE 612—Urban Transportation Models. 3 credits
Prerequisite: CE 512. Currently used mathematical models of traffic planning and urban activity. Trip generation, distribution and assignment. Modal split.

CE 613—Traffic Engineering Operations and Analysis. 4 credits
Prerequisite: CE 513 or consent of instructor. Operational techniques used to optimize traffic flow including traffic control systems. Maintenance operations. Freeway operations and control. Intersection channelization.

CE 614—Highway Planning Decisions. 3 credits
Highway finance and administration, highway needs analysis, economics of highway location, highway planning studies.

CE 616—Highway Safety Analysis. 3 credits
Prerequisite: CE 513. Accident reporting systems, statistics and characteristics of accidents, accident reconstruction and investigation procedures, factors involved in highway accidents, accident reduction and effects minimization.

CE 617—Airport Planning and Operations. 3 credits
Prerequisite: CE 515 or consent of instructor. Airport configuration, ground movements, baggage movements, parking, aircraft delay analysis, airport access, simulation of airport operations.

CE 618—Freeway Design and Operations. 4 credits
Prerequisite: CE 513. Operational characteristics of freeway systems. Geometric design configurations and effect on operation. Advanced analysis techniques. Freeway surveillance and control.

CE 619—Traffic Flow Theory. 4 credits
Prerequisite: CE 513 or consent of instructor. Macroscopic and microscopic traffic flow models, simulation, traffic system and network models, freeway corridor models.

CE 620—Groundwater Hydraulics. 3 credits
Prerequisite: CE 521. Laminar flow through porous isotropic and anisotropic media. Two-dimensional flow problems and potential theory methods. Three-dimensional flow. Multiple phase flow. Salt water intrusion. Dispersion. Turbulent groundwater flow. Transient flow.

CE 622—Open-Channel Hydraulics 2. 3 credits
Prerequisite: CE 522. Unsteady open-channel flow. Equation of motion. Method

of characteristics. Surge formation. Dam-break problem. Flood waves. Rating curves and expressions for discharge.

CE 623—Sediment Transport. 3 credits

Prerequisite: CE 522. Alluvial water courses. Critical shear stress and stable channels. Modes of sediment motion and bed formation. Suspended load. Bed-load formulas and entrainment at the bed. Transport in closed conduits. Natural rivers. Meanders.

CE 624—Hydraulic Models and Analogs. 3 credits

Prerequisite: CE 420. Principles of hydraulic similitude. Special model laws and their limitations. Dimensional analysis. Distorted models with fixed or movable bed. Calibration of models; interpretation of model results. Electrical and laminar flow analogs. Applications.

CE 625—Hydraulic Measurements in Laboratory and Field. 3 credits

Prerequisite: CE 420. Modern hydraulic laboratory. Flumes and test rigs. Advanced methods for measurement of head, velocity, discharge, sediment transport. Auxiliary electronic equipment.

CE 626—Advanced Hydraulic Problems. 1 to 9 credits

Prerequisites: CE 520, CE 521. Advanced analysis and design problems in hydraulics and hydraulic engineering. May be repeated with change of content up to a maximum of 9 credits.

CE 627—Hydraulic Transients. 3 credits

Prerequisite: CE 420. Unsteady pipe flow. The surge tank. Waterhammer analysis. Numerical and graphical methods. Digital programming of unsteady flow situations.

CE 628—Hydraulics of Stratified Flow. 3 credits

Prerequisites: CE 420, CE 522. Uniform and nonuniform flow in multilayered systems, including hydraulic jumps and saline wedges. Oscillatory motion and interfacial mixing. Continuous-density gradients. Diffusion.

CE 640—Bituminous Materials. 3 or 6 credits

Prerequisite: CE 410. Engineering analysis of strength and deformation mechanisms for asphalt and asphalt-aggregate systems; sampling and testing.

CE 641—Advanced Metal Structures. 3 credits

Behavior of structural materials under static, dynamic, and repeated loads. Effects of temperature. Materials problems in structural design.

CE 660—Advanced Soil Mechanics. 3 to 9 credits

Prerequisite: CE 460. Application of soil mechanics to the design and construction of buildings, foundations, earth structures, and highways. May be repeated with change of content up to a maximum of 9 credits.

CE 661—Advanced Foundations. 3 or 6 credits

Prerequisites: CE 461, CE 672, CE 660. Special foundations using most recent information from soil mechanics and structural analysis. Pile foundations, mats, retaining walls and structures such as piers. May be repeated with change of content up to a maximum of 6 credits.

CE 662—Structure and Engineering Properties of Soils. 3 to 9 credits

Factors influencing mechanical properties of soils; effective stress, cohesion and friction, shear-consolidation interaction, pore pressures, creep and dynamic effects. Research and laboratory instruction. May be repeated with change of content up to a maximum of 9 credits.

CE 663—Soil Dynamics. 3 to 6 credits

Dynamic principles; lumped systems; phase plane solution; elastic half-space theory; soil behavior under dynamic loading; foundation design problems under impulse, earthquake, pavement and steady state vibrations.

CE 664—Special Studies in Soil Engineering. 1 to .9 credits

Topics in theoretical or applied soil mechanics. Emphasis on special interests of students. May be repeated with change of content up to a maximum of 9 credits.

CE 670—Topics in Structural Dynamics. 3 to 6 credits

Prerequisite: CE 674 or consent of instructor. Analysis and design studies in selected topics such as dynamic response of structures, design for blast loads, and design for seismic forces.

CE 671—Advanced Reinforced Concrete. 3 to 6 credits

Prerequisite: CE 474. Research in reinforced concrete and development of building code requirements; ultimate load theories and their application to design; special design problems. May be repeated with change of content up to a maximum of 6 credits.

CE 672—Analysis of Statically Indeterminate Structures. 1 to 6 credits

Prerequisites: CE 371, CE 372. Frames with variable moment of inertia; arch and ring analysis by elastic center and column analogy; matrix solutions; redundant trusses; moment and shear distribution. May be repeated with change of content up to a maximum of 6 credits.

CE 673—Advanced Structural Laboratory. 3 credits

Prerequisites: CE 371, CE 372. Model studies and analysis. Applications to static and dynamic loadings. Mechanics of similitude and dimensional analysis. Vibration of beams; research studies.

CE 674—Advanced Structural Analysis. 3 to 6 credits

Prerequisites: CE 371, CE 372, ESM 302. Approximate methods of analysis for structural members of variable section modulus, including problems on vibrations, column buckling, beam-columns, beams on elastic supports. May be repeated with change of content up to a maximum of 6 credits.

CE 675—Advanced Structural Problems. 1 to 9 credits

Selected topics in structural engineering. May be repeated with change of content up to a maximum of 9 credits.

CE 676—Design of Framed Structures. 3 to 6 credits

Prerequisites: CE 671, CE 672. Design of continuous trusses; secondary stresses; design of rigid frames, multi-story frames, and arches. May be repeated with change of content up to a maximum of 6 credits.

CE 677—Design of Folded Plates and Shells. 3 to 6 credits

Prerequisites: CE 671, CE 672. Analysis and design of folded plate, shell, tank, and cable-supported structures. May be repeated with change of content up to a maximum of 6 credits.

CE 679—Nonlinear Structural Analysis and Design. 3 to 9 credits

Prerequisite: CE 672. Rigid-plastic and multilinear analysis and design of beams and frames. Yield line theory of slabs. Deflection analyses of columns, frames, curved compression members and suspension systems, with design applications. May be repeated with change of content up to a maximum of 9 credits.

CE 680—Advanced Prestressed Concrete Design. 3 credits

Prerequisites: CE 474, CE 570. Design and limit analysis of prestressed concrete

structural systems. Continuous beams, slabs, frames, composite members. Prestressed concrete reservoirs, structural systems in building construction, foundations, harbors.

CE 681—Air Photo Interpretation: Engineering Applications. 3 credits

Prerequisite: CE 512 or CE 561 or consent of instructor. Interpretation of aerial photography for the evaluation and planning of transportation systems and selection of desirable sites for construction of civil engineering projects.

CE 682—Air Photo Interpretation: Terrain Analysis. 4 credits

Prerequisite: CE 681 or consent of instructor. Interpretive techniques used to identify soils, rocks, and engineering problems from aerial photography.

CE 690—Matrix Methods in Structural Analysis. 3 to 6 credits

Matrix algebra relating to structural analysis. Development of matrix-method solutions for trusses and rigid frames. Problems programmed for the digital computer. May be repeated with change of content up to a maximum of 6 credits.

CE 691—Graduate Civil Engineering Seminar. 0 to 3 credits

Literature and developments in civil engineering. May be repeated with change of content up to a maximum of 3 credits.

CE 696—Individual Work. 1 to 9 credits

Individual engineering projects suitable for Master of Engineering degree. May be repeated with change of content up to a maximum of 9 credits.

CE 699—Master's Research. 1 to 17 credits

CE 799—Doctoral Research. 1 to 17 credits

CLINICAL PSYCHOLOGY

GRADUATE FACULTY 1970-71

Cohen, L. D., *Chairman*; Davis, H. C.; Goldman, J. R.; Mottola, W. C.; McGee, R. K.; Perry, N. W.; Satz, P.; Van De Riet, V. D.; Wolking, W. D.

The faculty of clinical psychology offers the following specialized graduate courses under the auspices of the Department of Psychology of the College of Arts and Sciences. The courses are described fully in that section of the catalog. The master's and doctor's degrees appropriate to clinical psychology are awarded through the Department of Psychology of the College of Arts and Sciences.

PSY 610—Seminar in Psychopathology. 4 credits

PSY 630—Individual Work. 1 to 5 credits

PSY 641—Personality Assessment 1. 4 credits

PSY 642—Personality Assessment 2. 4 credits

PSY 643—Personality Assessment 3. 4 credits

PSY 644—Personality Assessment 4. 4 credits

PSY 651—Practicum in Professional Psychology. 5 credits

PSY 680—Seminar in Developmental Psychology: Cognitive Processes. 4 credits

PSY 699—Master's Research. 1 to 17 credits

PSY 734—Seminar: Current Clinical Literature. 4 credits
PSY 735—Problems in Psychological Treatment. 4 credits
PSY 736—Seminar: Theory and Research Methods in Community Psychology. 3 credits
PSY 737—Theory and Practice of Psychological Consultation. 4 credits
PSY 738—Seminar: Advanced Research Methods in Community Psychology. 4 credits
PSY 743—Psychodiagnostic Appraisal and Assessment. 4 credits
PSY 755—Internship. 5 credits
PSY 799—Doctoral Research. 1 to 17 credits

COASTAL AND OCEANOGRAPHIC ENGINEERING

GRADUATE FACULTY 1970-71

Dean, R. G., *Chairman*; Jen, Y.; O'Brien, M. P.; Partheniades, E.; Purpura, J. A.; Shemdin, O. H.; Verma, A.

Graduate Coordinator: O. H. Shemdin

The following *Engineering Common Courses* are available for graduate major credit: EGC 601—Theory of Fluid Flow 1; EGC 602—Theory of Fluid Flow 2; EGC 603—Theory of Fluid Flow 3; EGC 604—Boundary Layer Theory; EGC 605—Theories of Turbulent Flows.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

COE 560—Ocean Engineering. 4 credits

GRADUATE COURSES

COE 610—Ocean Waves 1: Linear Theory. 4 credits
Prerequisites: Courses in calculus, differential equations, and fluid dynamics. Ocean wave classification; solution of the linearized boundary value problem; simple harmonic waves; shoaling effects; internal waves.

COE 611—Ocean Waves 2: Nonlinear Theory. 4 credits
Prerequisite: COE 610. Perturbation development of nonlinear water wave theories. Regions of validity of various theories. Dynamics and kinematics of nonlinear wave trains composed of single and multiple fundamental components.

COE 612—Ocean Wave Spectra. 4 credits
Prerequisite: COE 610. Ocean wave spectra: measurement, analysis, and application. Systems approaches to calculation of responses of linear and nonlinear coastal and oceanographic processes.

COE 613—Estuarial Hydromechanics and Engineering 1. 4 credits
Prerequisite: COE 610. Tidal theory. Analytical and numerical methods for computation of one- and two-dimensional propagation of tides and storm surges in estuaries and bays; method of characteristics; hydraulic bore; seiches; solitary wave.

COE 614—Estuarial Hydromechanics and Engineering 2. 4 credits
Prerequisites: CE 628, COE 613. Salinity intrusion in tidal estuaries; diffusion dispersion entrainment and mixing; analytical and numerical methods for predicting salinity intrusion and distribution of pollutants; laboratory exercises.

COE 615—Estuarial Hydromechanics and Engineering 3. 4 credits
Prerequisite: COE 614 or consent of instructor. Estuary shoaling and dredging practices; tidal energy; model investigations and study of selected case histories.

COE 620—Coastal Structures 1. 4 credits
Prerequisite: COE 610. Design principles for breakwaters, jetties and piers, shore protection, harbor design, offshore structures.

COE 621—Coastal Structures 2. 4 credits
Prerequisites: COE 610, COE 620. Case studies in the design and performance of coastal and offshore engineering construction.

COE 630—Littoral Processes. 4 credits
Prerequisite: COE 610. Longshore currents and sediment transportation by waves and wind; effects of groins, jetties, and other coastal structures on littoral processes.

COE 631—Simulation Techniques. 4 credits
Similitude laws, analog and numerical modeling, studies of littoral drift, harbor resonance, wind-driven circulation, storm surge, wave generation.

COE 632—Selected Field and Laboratory Problems. 3 to 8 credits
Field investigations employing modern research techniques and instrumentation; correlation of measurements with predictions.

COE 640—Physical Oceanography. 4 credits
Prerequisites: Calculus and differential equations. Historical introduction. Structure of the oceanic basins. Physical and chemical properties of sea water and property distributions. Heat budget, dynamics of ocean movement and oceanic waters.

COE 641—Air-Sea Interaction 1: Microscale. 4 credits
Prerequisite: COE 610. Equations of motion and stresses at the air-sea interface; the classical instability theory; recent theories of energy transfer from air to water; thermodynamic considerations; the growth of waves; wave forecasting.

COE 642—Air-Sea Interaction 2: Macroscale. 4 credits
Prerequisites: Basic courses in calculus and fluid mechanics. Composition and properties of the marine atmosphere; air-sea fluxes and energy transfer; global heat and water budget; tropical disturbances; large-scale momentum exchange.

COE 643—Advanced Topics in Coastal and Oceanographic Engineering. 1 to 6 credits
Wave forces, internal waves; sediment transport; surges in basins; instrumentation; advanced data analysis techniques; nonlinear wave mechanics; ship waves.

COE 699—Master's Research. 1 to 17 credits

COMMUNICATIVE DISORDERS

GRADUATE FACULTY 1970-71

Bzoch, K. R., *Chairman*; Pollock, K. C.; Hammer, L. C.; Scroggie, E., Jr.

The faculty of communicative disorders is primarily responsible for interdisciplinary clinical teaching and reasearch for the Colleges of Health Related

Professions, Medicine, Dentistry, and Nursing in aspects of speech pathology and audiology related to the professional degree programs of these colleges.

Courses and degrees in speech pathology and audiology are offered by the Department of Speech in the College of Arts and Sciences. The descriptive listings of courses in speech pathology and audiology may be found under Department of Speech in the undergraduate and graduate catalogs. The following courses are customarily taught by faculty of the College of Health Related Professions who also hold appointments in the Department of Speech.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

SCH 561—Principles of Audiological Evaluation. 4 credits

GRADUATE COURSES

SCH 660—Seminar in Audiology: Diagnostic Procedures.
SCH 655—Seminar in Speech Pathology and Audiology: Cerebral Palsy. 4 credits
SCH 657—Seminar in Speech Pathology and Audiology: Cleft Palate. 4 credits
SCH 749—Practicum in Speech Pathology in a Medical-Dental Setting. 3 to 10 credits
SCH 769—Practicum in Audiology in a Medical Setting. 3 to 10 credits

COUNSELOR EDUCATION

GRADUATE FACULTY 1970–71

Lister, J. L., *Chairman*; Carter, T. A.; Cosby, B. W.; Cranney, A. G.; Duncan, C. W.; Johnson, R. H.; Kline, W. E.; Landsman, T.; Lane, D.; Lynch, A. Q.; McMillin, M. R.; McMurrain, T. T.; Muthard, J. E.; Myrick, R. D.; Riker, H. C.; Schmidt, M. R.; Sharp, B. L.; Stripling, R. O.; Tolbert, E. L.; Wittmer, P. J.

Graduate Coordinator: J. L. Lister

GRADUATE COURSES

EDC 610—Principles of Guidance: The Helping Relationship. 4 credits

Prerequisite or corequisite: EDF 641. Theoretical bases of guidance and counseling. Common and divergent principles for helping the individual's personal growth as discovered in formal, informal, and professional human relationships.

EDC 611—Vocational Development. 4 credits

Vocational development and the role of occupational and educational information in the individual's vocational development process.

EDC 612—Techniques of Guidance and Personnel Work. 5 credits
Prerequisite: EDF 440 or EDF 442. Guidance practices for teachers, supervisors, administrators, and other school personnel not majoring in guidance and personnel work.

EDC 613—Personnel Testing. 4 credits
Prerequisite: EDF 360 or EDF 450. Selection and application of typical psychological tests used in counseling and personnel work. Use of tests in counseling to aid in self-understanding.

EDC 614—Counseling Theory. 5 credits
Prerequisites or corequisites: EDF 641, EDC 610. Corequisite: EDC 620. Major contemporary and historical theories in counseling including Freudian, neo-Freudian, Rogerian, existential, and behavioristic.

EDC 615—Supervised Practice in Counseling. 5 credits
Prerequisites: EDC 614, EDC 620, written permission from the department chairman at least six weeks in advance of registration. Supervised practice in individual and group counseling in a setting appropriate to the student's professional objectives. May be repeated up to a maximum of 10 credits.

EDC 616—Supervised Practice in Student Personnel Work. 5 credits
Prerequisites: Ten credits in EDC 615, written permission from the department chairman at least six weeks in advance of registration. Supervised practice in student personnel work in settings appropriate to the student's professional objectives. May be repeated up to a maximum of 10 credits.

EDC 618—Organization and Administration of Guidance and Personnel Programs. 4 credits
Prerequisite or corequisite: EDC 614. Organizing and administering guidance and personnel programs in educational institutions and allied agencies.

EDC 620—Laboratory in Counseling. 1 credit
Corequisite: EDC 614. Minimum of 3 clock hours per week spent in audio and video recording of role playing, discussion of professional films and tape recordings in counseling, and observations of counseling. Supervisory and consultative relationships in counseling.

EDC 621—Sensitivity Exploration Laboratory. 1 credit
Prerequisite or corequisite: EDC 610. Required of all students in counselor education. Opportunity, via participation in a group experience, to increase intra and interpersonal awareness and sensitivity.

EDC 622—Counseling with Children. 4 credits
Prerequisites: EDC 614, EDF 640. Counseling relationship as it applies to children. Emphasis on play techniques and new approaches toward helping children achieve high-level personal fulfillment.

EDC 623—Group Procedures in Guidance and Personnel Work. 4 credits
Prerequisites: EDC 614, EDC 620. Groups, group guidance, and group dynamics. Techniques of role playing, life-simulation games, psychodrama, sociodrama, and creative drama utilized in assisting students.

EDC 624—Group Counseling. 4 credits
Prerequisites or corequisites: EDC 623, EDC 615. Different group counseling approaches and models; treatment of group counseling goals, composition, phases, leadership behavior, and research.

EDC 630—Individual Work. 2 to 5 credits
Prerequisites: Consent of staff member and department chairman. Only graduate

students who have completed a minimum of 9 hours of graduate work will be approved for this course. For advanced students who wish to study problems in counseling and personnel work under supervision of a staff member. Before registering, a student must have approval of the proposed project. May be repeated with change of content up to a maximum of 15 credits.

EDC 640—Student Personnel Services in Higher Education. 4 credits

Prerequisites: EDC 641, EDC 610. Student personnel programs in junior colleges, colleges, and universities. Philosophy, organization, and administration of these programs within the context of the purposes and programs of higher educational institutions.

EDC 641—The College Community and the Student. 4 credits

Prerequisite or corequisite: EDC 610. Mores of the college community, characteristics of the college student, relationship of these to personal, social, and intellectual development.

EDC 659—Seminar For Counseling in Specialized Settings. 4 credits

Required for beginning students in counselor education. Orientation to professional counseling and student personnel work. Separate sections for students preparing to work in elementary and secondary schools, junior colleges and higher education institutions, and agencies allied to education. May be repeated with change of content up to a maximum of 8 credits.

EDC 660—Problems in Personnel Work. 3 to 10 credits

Seminar in special problems arranged by the department for persons engaged in personnel work in education or allied areas. May be repeated with change of content up to a maximum of 10 credits.

EDC 690—Special Topics. 2 to 5 credits

Prerequisite: Permission of department chairman. May be repeated with change of content up to a maximum of 15 credits.

EDC 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

EDC 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

EDC 710—Practicum in Counseling. 4 credits

Prerequisites: EDC 615, EDC 619, and written permission from the department chairman at least six weeks in advance of registration. Supervised experiences in counseling in a setting appropriate to the student's professional goals. Students will register for a maximum of 4 credits for each of 3 consecutive quarters.

EDC 711—Practicum in Group Counseling. 4 credits

Prerequisites: EDC 619, EDC 624, and written permission from the department chairman at least six weeks in advance of registration. Supervised experiences in group counseling appropriate to the student's professional goals.

EDC 715—Seminar in Personnel Work. 5 credits

Admission limited to graduate students in the Advanced School who are near the completion of course work for a degree. Anticipated problems and issues in counseling and guidance, and preparation for leadership in their resolution.

EDC 716—Internship in Personnel Work 1. 5 credits

Prerequisites: EDC 710 and written application for admission to the course at least six weeks before registration. Opportunity provided to selected students for supervised field work.

EDC 717—Internship in Personnel Work 2. 5 credits

Continuation of EDC 716.

EDC 718—Internship in Personnel Work 3. 5 credits
Continuation of EDC 717. The student's responsibility as a consultant or supervisor in counseling and personnel work.

EDC 721—Consultation Procedures. 4 credits
Prerequisite: Two quarters credit of EDC 615. Admission limited to students in the Advanced School. Theory and practice of consultation; roles of the consultant and consultee; counselor's function in assisting the professional and allied worker to facilitate personal growth of others.

EDC 722—Evaluative Research in Counseling, Guidance and Personnel Work. 5 credits
Prerequisite: EDC 613. Process, outcome, and program evaluation research in counseling, guidance, and personnel work. The student evaluates research literature and designs an evaluative study related to his professional interests.

DAIRY SCIENCE

GRADUATE FACULTY 1970-71

Van Horn, H. H., Jr., *Chairman;* Browning, C. B.; Head, H. H.; Krienke, W. A.; Marshall, S. P.; Mull, L. E.; Smith, K. L.; Thatcher, W. W.; Wilcox, C. J.; Wing, J. M.

Graduate Coordinator: C. J. Wilcox

The Department of Dairy Science offers work leading to the Master of Science in Agriculture and the Master of Agriculture degrees and, in collaboration with the departments of Animal Science and Bacteriology, the Doctor of Philosophy degree.

Areas of interest include animal breeding and genetics, nutrition, physiology, biochemistry, management, microbiology, milk chemistry, and the processing of milk and milk products. A departmental prerequisite for admission to graduate study in Dairy Science is a strong undergraduate background in the physical or biological sciences. A prospective graduate student need not have majored in Dairy Science as an undergraduate.

The following courses in related areas will be acceptable for graduate credit as part of the candidate's major: AL 602—Quantitative Genetics; AL 607—Physiology of Reproduction; AL 651—Advanced Animal Nutrition; AL 655—Mineral Nutrition and Metabolism; AL 656—Ruminant Physiology and Metabolism; STA 601—Advanced Methods of Statistics.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

DY 501—Physiology of Lactation. 5 credits

GRADUATE COURSES

DY 601—Dairy Science Research Techniques. 4 credits
Methods employed in research in specialized dairy fields: genetics, nutrition,

physiology, microbiology, chemistry, or dairy technology. Use of equipment, materials and methods, experimental designs, and statistical analysis.

DY 602—Problems in Dairy Science. 1 to 5 credits

Research problems in dairy husbandry or dairy manufacturing. May be repeated with change of content up to a maximum of 12 credits.

DY 603—Graduate Seminar in Dairy Science. 1 credit

DY 604—Endocrinology. 4 credits

Prerequisites: BCH 511, BCH 512, VY 523. The endocrine system including anatomy of the brain, neuroendocrine control, gland function, hormone structure and biosynthesis, and relationship to reproduction, lactation, growth, and metabolism.

DY 605—Advanced Dairy Cattle Management. 4 credits

Modern scientific basis for management of Florida dairy cattle, including nutrition, physiology, and genetics. Group feeding, reproduction, and management under semitropical conditions.

DY 606—Energy Metabolism. 4 credits

Prerequisites: BCH 402, BCH 403. Relationship of anatomy, physiology, and biochemistry to transformation of feed energy to free energy; energy utilization at levels of the cells, the organism, and the organism in relation to its environment.

DY 610—Advanced Dairy Technology. 5 credits

Theories associated with chemical and physical changes of milk constituents during processing and storage of dairy products. Special tests and quality measurements essential in identifying and measuring degrees of these changes.

DY 611—Advanced Dairy Products Processing. 5 credits

Advanced methods of processing, and approaches to new product development through rearranged operations and adaptations of specialized types of equipment and their functions.

DY 612—Advanced Dairy Microbiology. 5 credits

Methods of microbiological control of dairy products, with emphasis on physiological chemistry of dairy microorganisms and metabolic pathways in dairy product fermentations.

DY 664—Topics in Genetics. 2 to 4 credits

Identical with AL 664, AY 664, BTY 696, PY 664, ZY 664. May be repeated with change of content up to a maximum of 12 credits.

DY 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

DY 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

DY 699—Master's Research. 1 to 17 credits

ECONOMICS

GRADUATE FACULTY 1970-71

Goffman, I. J., *Chairman;* Blodgett, R. H.; Bradbury, R. W.; Donovan, C. H.; Frazer, W. J., Jr.; Fristoe, C. W.; Geithman, D. T.; Goddard, F. O.; Jackson, E. L.; Kafoglis, M. Z.; Keig, N. G.; Koefod, P. E.; Langham, M. R.; Lanzillotti, R. F.; Osterbind, C. C.; Perry, J. M.; Roberts, P. E.; Vernon, J. R.; Woodruff, W.

Graduate Coordinator: I. J. GOFFMAN

Though no graduate major may be completed without adequate course work on the 600 or higher level, certain undergraduate courses in economics are available for graduate credit as a part of a candidate's major. These are: ES 455—Government Control of Business; ES 410 and ES 411—Development of Modern Western Economy; ES 469—Analysis and Forecasting of General Business Fluctuations.

For admission to courses 600 level and above, the student must have been admitted to the Graduate School and normally should have had undergraduate courses in fields pertinent to the graduate courses selected; or, where necessary, special arrangements may be made with the approval of the department chairman.

Ph.D. Core: ES 601, ES 602, ES 605, ES 606, ES 665, ES 669.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ES 513—ECONOMIC AND SOCIAL HISTORY OF RUSSIA. 3 credits
ES 521—CENTRAL BANKING AND MONETARY POLICY. 5 credits
ES 531—CENTRAL GOVERNMENT FINANCE. 5 credits
ES 535—STATE AND LOCAL FINANCE. 5 credits
ES 536—GOVERNMENTAL BUDGETING AND FINANCIAL ADMINISTRATION. 3 credits
ES 543—FOREIGN EXCHANGE AND INTERNATIONAL FINANCIAL INSTITUTIONS. 3 credits
ES 545—FINANCIAL INSTITUTIONS AND FISCAL POLICIES OF SELECTED LATIN AMERICAN COUNTRIES. 3 credits
ES 547—CONTEMPORARY ECONOMIC PROBLEMS IN SUB-SAHARA AFRICA. 3 credits
ES 549—COMPARATIVE ANALYSIS OF ECONOMIC SYSTEMS. 4 credits
ES 561—ECONOMETRIC MODELS AND METHODS 1. 5 credits
ES 562—ECONOMETRIC MODELS AND METHODS 2. 5 credits
ES 572—ECONOMICS OF THE LABOR MARKET. 5 credits
ES 581—URBAN ECONOMICS. 5 credits
ES 585—ECONOMICS OF HUMAN RESOURCE DEVELOPMENT. 3 credits
ES 591—MASTERPIECES IN THE SOCIAL SCIENCES 1. 4 credits
ES 592—MASTERPIECES IN THE SOCIAL SCIENCES 2. 4 credits
ES 593—MASTERPIECES IN THE SOCIAL SCIENCES 3. 4 credits

GRADUATE COURSES

ES 601—MACRO-ECONOMIC THEORY. 5 credits
Classical, Keynesian, and post-Keynesian aggregate income and employment analysis. Determination of price level and interest rate.

ES 602—PRICE THEORY. 5 credits
Analysis, criticism, and restatement of neo-classical price and production theories. Demand, supply, cost of production, and price determination under various conditions of the market.

ES 603—SOCIAL AND ECONOMIC ACCOUNTING. 5 credits
Identical with ATG 603. Social accounts and comparative economic accounting

systems. Emphasis on national income accounting, the national balance sheet, sector accounts, and flow of funds analysis.

ES 604—Capital Theory, Production, and Growth. 5 credits

Prerequisite: ES 601. Capital Theory from the Austrian school to current developments. Production, distribution, and economic growth within the framework of Capital Theory. Empirical and statistical studies of important variables.

ES 605—The Development of Economic Thought. 5 credits

The two chief approaches in economic thought. Emphasis on philosophical outlook and methodology. Analytical approach and role of mathematics; calculus surveyed and related to neo-classical theory. Relates the institutional approach to history and other social sciences; cultural theory of capitalist evolution.

ES 606—The Development of Economic Thought. 5 credits

Economic thought chronologically from Greek to contemporary times—including the chief schools in Great Britain, the Continent, and the United States. Marx and the socialists, nonorthodox thinkers, and critics of the classical school are treated equally with the main tradition.

ES 608—Present-Day Schools of Economic Thought. 5 credits

Contemporary American and English economic thinking with particular reference to the developments occurring between the two World Wars. The writings of Hansen, Mitchell, Clark, and Commons in the United States, and of Keynes, Cole, Robinson, and Hobson in England.

ES 610—The American Economy to 1860. 5 credits

A functional approach. World economic conditions that led to the settlement of America; the colonial period; the period of economic transition; the westward movement and the rise of a national economy; economic causes of the Civil War.

ES 611—The American Economy Since 1860. 5 credits

The closing of the economic frontier. The development of a capitalistic economy and the trend toward economic and financial imperialism. Economic problems of the wars of 1914-18 and 1939-45, and postwar economic adjustments, domestic and foreign.

ES 614—The United States in the World Economy (1783-1960). 5 credits

Identical with HY 614. The interrelatedness of the United States' economy with the economies of other lands; circumstances which have enabled the American people to alter the course of world history.

ES 615—Economics of Business Decisions. 5 credits

Primarily for candidates for the degree Master of Business Administration. Economic principles directly related to managerial decisions. An attempt is made to synthesize the student's training in economic theory and in the fields of applied business practice.

ES 616—Economic Environment of Business. 4 credits

Primarily for candidates for the degree Master of Business Administration. Gives the student a better grasp of the politico-economic environment in which he will be operating his business. History and analysis of modern economic performance and policy in the United States, with emphasis on current economic problems and their significance for business decision making.

ES 617—Theory of Economic Development. 5 credits

Broad analytical, non-historical framework for examining economic underdevelopment and possible escape therefrom. Transition to secular economic growth

and principles by which an underdeveloped country can achieve development objectives.

ES 618—Economic Development Seminar. 5 credits

Theory and problems of economic development pertinent to market and nonmarket economies, with emphasis on the relationship between economic system development and economic growth.

ES 621—Monetary Theory. 5 credits

Prerequisite: ES 321 or an undergraduate major in economics. Evolutionary and contemporary aspects of monetary theory. Qualities and characteristics of money, rate of interest, effectiveness of monetary policy, flow of funds between the various sectors of the economy and the financial markets, the relationships between saving, investment, employment, price-level changes and capital formation.

ES 622—Money, Prices, and Business Cycles. 5 credits

Prerequisite: ES 321. Economic instabilities in capitalistic society, with emphasis on forces operating to bring about changes in the general level of prices, including prices of productive agents, employment, and income.

ES 625—Seminar in Monetary Economics. 5 credits

Prerequisite: Background in monetary economics and econometrics. Current topics of research in the journals, studies by government agencies, and other published and unpublished materials.

ES 630—Individual Work in Economics. 1 to 9 credits

Prerequisites: Permission of the department and of the Director of Graduate Studies. Reading and/or research in the several areas of economics as needed by graduate students. May be repeated with change of content up to a maximum of 9 credits.

ES 631—Theory of Public Finance. 5 credits

Prerequisite: 12 credits in economics, including public finance. Theoretical aspects of the allocation and distribution functions of the modern state. Theories of public expenditure, tax incidence and effects, the burden of public debt.

ES 633—Fiscal and Monetary Policy. 5 credits

Prerequisite: 12 credits in economics, including money and public finance. Tools for promoting economic stabilization and growth. Opposing viewpoints as to proper scope and relation of monetary and fiscal controls.

ES 635—Welfare Economics. 5 credits

A survey of welfare economics. Technical welfare formulations related to organic concepts of welfare and to political action in a democracy. Possibilities of normative economics evaluated.

ES 641—Theory of International Trade. 5 credits

Historical and economic background of foreign trade; theory of international trade; fundamentals of international exchange; international commercial policies and international trade; exchange fluctuations and their control; international monetary institutions.

ES 644—International Economic Relations. 5 credits

Capital formation in the underdeveloped countries, economic integration, balance of payments and international monetary reform, the economic consequences of population pressures and economic relations between the advanced and other nations.

ES 645—The Economy of Spanish Latin America. 5 credits

Contemporary economic and commercial problems in Spanish Latin America; current developments in production, transportation, and trade of the various countries.

ES 646—The Economy of Brazil. 5 credits
Economic development and contemporary economic and commercial problems of Brazil; production, transportation, and trade from both a national and a regional point of view.

ES 647—Financial and Fiscal Institutions of Selected Sub-Saharan Countries. 5 credits
Public finances and the money and banking policies of representative countries of Africa.

ES 649—Economic Systems Seminar. 5 credits
Market and non-market types of economies, their characteristics and economics, and their different significance for systems of government and general social orders, legal and juridical systems, and for business and public policy.

ES 654—Economics of Regulated Industries. 5 credits
Prerequisites: ES 301, ES 302. Types and techniques of public control. Economic analysis and evaluation of regulatory and promotional policies. Administrative and legal aspects of the regulatory process. Special problems in particular industries.

ES 655—Industrial Organization and Social Control. 5 credits
Prerequisite: ES 455. Economic and other characteristics of modern industrial structures. Relationships between industrial structure, business conduct and economic performance. Measurement of concentration and evaluation of performance. Public policies toward monopoly, conspiracy and competition.

ES 657—Problems in Social Control. 5 credits
Prerequisites: ES 301, ES 302. Nature and causes of market failure. Problems in developing and applying concepts of public interest in a market economy. Institutional restraints to economic solutions; coordination of political and market decisions concerning the allocation of resources.

ES 660—Nonstochastic Models. 5 credits
Identical with AS 660. Prerequisite: MS 324 or ISE 401. The general linear programming model and its basic theorems, integer and nonlinear programming. Spatial equilibrium, input-output, and game theory models.

ES 661—Econometric Methods 1. 5 credits
Identical with AS 661. Prerequisite: STA 441. Stochastic models. The general linear model and problems associated with its use in econometric research. Theory of the simultaneous equation approach, model construction, and estimation techniques.

ES 662—Econometric Methods 2. 4 credits
Identical with AS 662. Prerequisite: ES 661 or AS 661. Single equation topics; errors in variables, nonspherical disturbances, and lagged variables. Dynamic simultaneous equation models and miscellaneous topics in multivariate analysis. Spectral and cross-spectral analysis.

ES 663—Research Seminar in Econometrics. 1 to 3 credits
Identical with AS 663. Prerequisite: ES 661. Empirical measurement in applied economics. Empirical problem requiring the construction, estimation, and defense of a quantitative economic model.

ES 666—Mathematical Economics 2. 5 credits
Prerequisites: ES 665 and some work in statistical methods or econometrics. Probability and simulation models of economic behavior; mathematical models from monetary economics.

ES 669—Problems in Statistics and Business Forecasting. 5 credits
Problems of linear operation regression analysis which may be used by managers as a basis for decision making. It will add to the student's knowledge of sophisticated statistical methods to aid in the analysis of current business problems.

ES 672—Organized Labor in the United States. 5 credits
Problems connected with the relationship of organized labor with itself, management, government, and the public; labor policy and public welfare.

ES 674—Labor Economics. 5 credits
Wage determination and the role of wages in the economy; the effects of collective bargaining on wages, prices, and employment.

ES 692—Neo-Classical Economics. 5 credits
Analysis, criticism and restatement of neo-classical theories concerning distribution of income. Rent, interest, wages, profits, personal distribution, supplementary distribution and noncapitalistic distribution. The writings of Marshall, Hicks, Cassel, Boulding, Pigou, Fisher, Douglas, Knight, Stigler, and Schumpeter provide background for the discussion.

ES 699—Master's Research. 1 to 17 credits

ES 799—Doctoral Research. 1 to 17 credits

EDUCATION—GENERAL

GRADUATE FACULTY 1970-71

Lewis, A. J., *Chairman*; Ahrens, M. R., Alexander, W. M.; Ambrose, E. V.; Bingham, N. E.; Cate, C. A.; Cooper, J.; Crews, R.; Durrance, C. L.; Fillmer, H. T.; Flannery, M. E.; Gardner, C. H.; Hass, C. G.; Hilliard, F. P.; Kidd, K. P.; Lawrence, G. D.; Myers, R. B.; Newcomb, A. P.; Packer, A. B.; Roberts, D. R.; Smith, A. B.; Wattenbarger, J. L.; Wenzel, E. L.; White, J. B.; Williams, E. L.

CROSS-DEPARTMENTAL COURSES FOR SPECIAL AREAS

College and Community College Teaching	Curriculum and Instruction
ED 603	ED 600
ED 640	ED 700
ED 641	ED 701
ED 642	ED 740
ED 743	ED 741
	ED 742
	ED 750

GRADUATE COURSES

ED 600—The School Curriculum. 4 credits
Philosophic and research bases underlying the development of the total school program from kindergarten through community college. Basic curriculum course for graduate students. Required in all graduate progarms in Curriculum and Instruction.

ED 601—The Emergent Middle School. 4 credits
Program, organization, and rationale of the newly emerging middle school in American school districts.

ED 603—The Community Junior College in America. 4 credits
Programs, issues, and problems of the community junior college.

ED 620—The Education of Culturally Disadvantaged Children and Youth. 4 credits
Curriculum content and procedures pertinent to the educational needs of culturally disadvantaged children and youth.

ED 630—Individual Work. 2 to 5 credits
For advanced students who wish to study individual problems under faculty guidance. Before registering in this course, a student must have approval of the proposed project. May be repeated with change of content up to a maximum of 15 credits.

ED 633—Methods and Problems of Supervision. 4 credits
Prerequisite: EDA 631. Methods of improving instruction.

ED 634—Group Process in Education. 4 credits
Group organization and operation, with opportunity to develop skills in group leadership and interpretation of group interaction.

ED 640—American Higher Education. 4 credits
History, philosophy, and policies of America's institutions of higher education with emphasis on current practices and problems.

ED 641—Practicum in College Teaching 1. 4 credits
Prior arrangements must be made with the coordinating professor of the College of Education. Provision is made for the student to teach under the supervision of a professor in his academic field.

ED 642—Practicum in College Teaching 2. 4 credits
Prior arrangements must be made with the coordinating professor of the College of Education. Continuation of ED 641.

ED 646—The Teaching of Special Science Programs. 3 to 6 credits
Preparation to teach particular science programs such as: AAAS, ESS, SCIS, ESCS Patterns and Processes, CHEMS, PSSC, CAI. May be repeated with change of content up to a maximum of 6 credits.

ED 648—Problems in Curriculum and Instruction. 3 to 15 credits
Covers topics not available in regularly listed courses. To be used for credit in institutes, workshops, and short credit courses. May be repeated with change of content up to a maximum of 15 credits.

ED 649—Subject-Area Planning for Elementary Teachers. 3 to 6 credits
Offered only by extension. A workshop for the development of individual, city-wide or county-wide plans for improving programs in language arts, social studies, mathematics, health, art, music, science, etc. May be repeated with change of content up to a maximum of 6 credits.

ED 651—Audio-Visual Education. 4 credits
Communication media available to the classroom teacher and an analysis of their theoretical bases in terms of current learning theory.

ED 652—Production and Utilization of Audio-Visual Materials. 4 credits
Prerequisite: ED 651. Designed to train materials supervisors, audio-visual co-

ordinators, and other school personnel in the production of materials by photographic processes.

ED 653—Organization and Operation of a Materials-of-Instruction Program. 4 credits

Prerequisite: ED 418 or ED 651. Administration of a school or county materials-of-instruction program, including arrangement of materials and equipment, organization and operation, financial report, standards, physical plant functions, and evaluation.

ED 654—Programmed Instructional Material. 4 credits

Evaluation and effective use of programmed instructional materials. Practice in construction of programmed materials provided in student's area of emphasis.

ED 657—Florida Workshop: Bulletin Series Division. 3 to 6 credits

Assistance for principals and teachers engaged in the preparation of curriculum bulletins. Registration limited to selected personnel. May be repeated with change of content up to a maximum of 6 credits.

ED 659—Laboratory in Corrective Reading. 4 to 8 credits

Prerequisite or corequisite: EDE 675. Diagnosis, correction, and prevention of reading difficulties in both elementary and secondary schools; work with children in the application of principles under study. May be repeated with change of content up to a maximum of 8 credits.

ED 660—Subject-Area Planning for Secondary Teachers. 4 credits

Offered only by extension. A workshop for the development of individual, city-wide, or county-wide plans for improving instruction in secondary school subjects.

ED 661—Problems in Reading. 4 credits

Prerequisite or corequisite: EDE 675. Specific reading problems, such as those encountered in the classroom situation, will be selected for exhaustive study by individuals or small groups; the teaching of reading on any grade level.

ED 663—Music in the Elementary School. 4 credits

Offered only by extension. An in-service training course open to elementary school teachers. Research work under supervision of the chairman of the Department of Music.

ED 664—Vocal Music in the Secondary School. 4 credits

Offered only by extension. An in-service training course open only to vocal music teachers. Research work under supervision of the chairman of the Department of Music.

ED 665—Orchestra Music in the Public Schools. 4 credits

Offered only by extension. An in-service training course open only to instrumental music teachers. Research work under supervision of the chairman of the Department of Music.

ED 666—Band Music in the Public Schools. 4 credits

Offered only by extension. An in-service training course open only to instrumental music teachers. Research work under supervision of the chairman of the Department of Music.

ED 667—Foundations of Music Education. 4 credits

Historical development and philosophy; comparison of United States with other countries and cultures; individuals, associations, and institutions that shape the music education program.

ED 670—Workshop in Human Relations in Education. 3 to 9 credits

Principles and practices in the field of human relations and their implications

for interpersonal and intergroup problems in the family, school and community. May be repeated with change of content up to a maximum of 9 credits.

ED 671—Foundations of Art Education. 4 credits

Evolution of art education in the United States and abroad.

ED 673—Aesthetic Experience. 4 credits

Applied aesthetics. The nature of education for aesthetic experience; the education of feeling. The development of a curriculum for aesthetic education.

ED 675—Curriculum in Art Education. 4 credits

Current major theories in the development of the art curriculum.

ED 676—The Teaching of Art in Higher Education. 4 credits

College programs in art: objectives, problems, and approaches to teaching.

ED 678—Art Education and Related Disciplines. 4 credits

Comparative analysis of concepts derived from related disciplines and their functions in art education. Art education within the larger framework of professional education.

ED 682—Field Laboratory for Faculty Study of Special Problems. 3 to 9 credits

Offered only by extension. To assist teachers in single schools, groups of schools, or county systems in improving certain subject areas or in working on special problems within the system. May be repeated with change of content up to a maximum of 9 credits.

ED 690—Special Topics. 2 to 5 credits

Prerequisite: Permission of department chairman. May be repeated with change of content up to a maximum of 15 credits.

ED 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

ED 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

ED 699—Master's Research. 1 to 17 credits

ED 700—Instruction: Theory and Research. 4 credits

Prerequisite: ED 600. Theories of instruction and research in the learning process, mental health, creativity, the thought process, human relations, group dynamics, communication, and other fields contributing to a theory of instruction.

ED 701—Curriculum: Theory and Research. 4 credits

Prerequisite: ED 600. Theories of curriculum and organization, and a survey of curriculum research and patterns of curriculum.

ED 720—Seminar in the Education of Disadvantaged Children and Youth. 4 credits

Open to advanced graduate students. Research and literature dealing with developing programs for culturally disadvantaged children and youth.

ED 731—Work of the Director of Curriculum. 4 credits

Duties of the director of curriculum examined from the standpoint of their administrative, coordinative, supervisory, and research aspects.

ED 740—Programs of Teacher Education. 4 credits

Organization and problems of teacher education institutions; types of students, patterns of curricula, functions of staff, significant organizations and agencies, and special studies.

ED 741—Internship in Teacher Education 1. 4 credits

Problems of pre-service teacher education and participation in the planning and teaching of pre-service courses.

ED 742—Internship in Teacher Education 2. 4 credits
Continuation of ED 741.

ED 743—Seminar: Curriculum in Higher Education. 4 credits
Prerequisite: ED 603 or ED 640. Issues and problems in college and university curriculums with emphasis on general education and curriculum evaluation.

ED 750—Bases of Curriculum and Instruction Theory. 4 credits
Prerequisite: ED 600. Application of theory and research in the behavioral sciences to the development of curriculum and instruction theory. May be repeated with change of content up to a maximum of 8 credits.

ED 751—Mathematics Education Seminar. 4 credits
Prerequisite: EDS 650 or EDE 650. Issues and problems in mathematics education and the investigation and planning of research relevant to selected problems.

ED 759—Practicum in Reading. 4 to 8 credits
Prerequisites: Post-master's status, reading certification or equivalent. Supervised experience in diagnosis and remedial techniques with severe reading disabilities. Primarily individual tutoring.

ED 760—Science Education Seminar. 4 credits
Prerequisite: EDS 660. Issues and problems in science education and the investigation and planning of research relevant to selected problems.

ED 761—Seminar in Reading. 4 credits
Prerequisites: EDE 675, ED 661, year of graduate study. Contemporary issues and research in reading.

ED 770—Seminar in English Language Arts. 4 credits
Prerequisites: EDE 670 or EDS 670; one year of graduate study. Contemporary developments and research in English language arts education.

ED 799—Doctoral Research. 1 to 17 credits

EDUCATIONAL ADMINISTRATION AND SUPERVISION

GRADUATE FACULTY 1970-71

Kimbrough, R. B., *Chairman*; Ahrens, M. R.; Alexander, S. K.; Alexander, W. M.; Boardman, G. R.; Bullock, L. M.; Eggert, C. L.; Forgnone, C.; Frossard, R. T.; Gilliland, J. W.; Hass, C. G.; Johns, R. L.; LaVire, W. A.; Myers, R. B.; Nunnery, M. Y.; Reid, W. R.; Roberts, D. Y.; Schafer, M. I.; Todd, E. A.; Wattenbarger, J. L.; White, J. B.

Graduate Coordinator: R. B. Kimbrough

GRADUATE COURSES

EDA 600—Educational Organization and Administration. 4 credits
Foundation course in school administration. Basic concepts, principles, and practices in local, state, and federal organization and administration.

EDA 601—Organization and Administration of Elementary Schools. 4 credits
Organization and administration of elementary schools in the light of purposes and functions. Emphasis on the skills and competencies desirable for leadership at a school center.

EDA 602—Organization and Administration of Secondary Schools. 4 credits

Duties and responsibilities of the school principal; competencies necessary for leadership in organizing, administering, supervising, and evaluating the secondary school center.

EDA 603—Public School Finance. 4 credits

State, local, and federal financing of education; the foundation program of school financing; principles and criteria of taxation for education; education and the national economy.

EDA 604—Legal Phases of Public School Administration. 4 credits

Legal status of schools in the United States; emphasizes Florida conditions, school laws, constitutional provisions, judicial decisions, Attorney General's rulings, and regulations of the State Board of Education.

EDA 605—Public School Business Administration. 4 credits

School financial accounting; the preparation and administration of budgets; purchasing procedures; the issuance of school securities; central services of public school business administration.

EDA 606—Supervised Practice in School Administration. 4 credits

Only advanced graduate students are permitted to enroll. Students are given opportunity to perform administrative duties under supervision. May be repeated with change of content up to a maximum of 8 credits.

EDA 607—Administration of School Personnel. 4 credits

Problems of the professional school staff and the administration of staff personnel in the public schools.

EDA 609—Problems in School Administration and Supervision. 4 credits

An in-service training course through regularly scheduled on-campus work conferences open only to superintendents and supervisors; or a problems course, offered through extension or on campus, for superintendents, supervisors, principals, junior college administrators, and trainees for such positions. May be repeated with change of content up to a maximum of 8 credits.

EDA 610—Organization and Administration of Adult Education. 4 credits

Overview of adult education in the United States; the role of administration in adult education; the job of the local director of adult education; Florida law and regulations relating to adult education in the public schools.

EDA 620—Administration in Special Education. 4 credits

Prerequisite: EDH 300 or EDH 600. Local, state, and federal organization and administration with emphasis on the administration of services to handicapped children.

EDA 630—Individual Work. 2 to 5 credits

For advanced students who wish to undertake an individual research project directly related to administration and supervision. May be repeated with change of content up to a maximum of 15 credits.

EDA 631—Educational Leadership 1. 4 credits

Basic course on the nature of educational leadership. Emphasis on the role of official leadership in group development, improving group structure, and program improvements.

EDA 632—Educational Leadership 2. 4 credits

Contemporary research on the diffusion of innovations, the planning of change,

organizational theory and political power in policy decision-making. The role of educational administrators and instructional leaders in the establishment of educational policies.

EDA 640—Utilization of Computers in Educational Administration. 4 credits

Prerequisite: EDA 600. Man-machine systems in educational administration. Electronic data processing and the school administrator, educational information systems, and other computer applications.

EDA 641—Systems Management in Educational Administration. 4 credits

Prerequisite: EDA 640 and statistics course. Application of select quantitative systems techniques from management and operations research to educational administration: utilities, queuing theory, graph theory, decision theory, game theory, simulation, and modeling.

EDA 690—Special Topics. 2 to 5 credits

Prerequisite: Permission of department chairman. May be repeated with change of content up to a maximum of 15 credits.

EDA 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

EDA 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

EDA 700—Educational Planning. 4 credits

Cooperative, long-range planning of educational programs, including school survey techniques and their application. Field experience in planning made available.

EDA 702—The School Plant. 4 credits

Planning of building programs and planning of school buildings ir. relation to the instructional needs; maintenance, operation, and utilization of school plants.

EDA 703—The Financing of Higher Education. 4 credits

Financing of higher education, junior college through university. Economics of higher education, application of the planning, programming, budgeting system to higher education. Evaluation of various models of financing education from federal, state, private sources, and student fees.

EDA 704—College Administration. 4 credits

Educational policies, functions, and practices in the administration of higher institutions.

EDA 705—The Law and Higher Education. 4 credits

Legal framework of colleges and universities; relationship between private and public institutions; federal and state statutory and constitutional provisions bearing on higher education; legal implications involved in administrative relationships with faculty and students.

EDA 706—Seminar: Theories of Educational Administration. 4 credits

Prerequisite: One year of graduate study. Basic theories of the organization and administration of public education; historical origins of theories; assumptions underlying current concepts of administration and theory development.

EDA 707—Research Design in Educational Administration. 3 credits

Prerequisite: EDF 760. Open only to students in the Advanced School. Individually identified problems in administration conceptualized in theoretical terms and appropriate research procedures determined.

EDA 710—Seminar: State and Regional Coordination and Control of Higher Education. 4 credits

Organizational structure and the basic principles of coordination and control of higher education at state and regional levels. Principles of leadership expressed through controlling boards and coordinating boards; role of boards and staff in planning development and operation; state, regional and national accrediting agencies.

EDA 720—Seminar in Administration and Supervision of Special Education. 8 to 12 credits

Prerequisites: EDA 620, EDA 600. Current problems in the provision of special education services in local, state, and federal programs.

EDA 721—Practicum: Special Education Administration. 4 credits

Prerequisites: EDA 720, 8 credits of special education, 8 credits of educational administration, consent of the instructor, and written request to enroll six weeks prior to registration. May be repeated with change of content up to a maximum of 12 credits.

EDA 730—Practicum in Supervision and Administration. 3 to 15 credits

A seminar and an internship in administration and supervision. May be repeated with change of content up to a maximum of 15 credits.

ELECTRICAL ENGINEERING

GRADUATE FACULTY 1970-71

Chen, W. H., *Chairman*; Bailey, R. L.; Bailey, T. L.; Boykin, W. H.; Brodersen, A. J.; Bullock, T. E.; Chenette, E. R.; Childers, D. G.; Couch, L. W.; Cross, J. L.; Director, S. W.; Dominiak, K. E.; Doty, K. L.; Dove, D. B.; Durling, A. E.; Elgerd, O. I.; Forsman, M. E.; George, T. S.; Harden, R. C.; Johnson, R. C., Jr.; Jones, L. E., III.; Latour, M. H.; Li, S. S.; Lindholm, F. A.; Lipovski, G. J.; Manders, A. M.; Nevis, A. H.; O'Malley, J. R.; Paige, A.; Ramey, R. A., Jr.; Rosier, N. E.; Sah, C. T.; Sashoff, S. P.; Shaffer, C. V.; Simons, F. O., Jr.; Skellett, A. M. (*Emeritus*); Smith, J. R.; Su, S. Y. W.; Sullivan, R. L.; Sutherland, A. D.; Teas, D. C.; Tou, J. T.; van der Ziel, A.; Walker, R. L.; Walter, W. A.; Ward, G. D.; Watson, J. K.; Weil, J. (*Emeritus*); Wheeler, L. A.; Wing, A. H.; Yii, R.; Zahn, M.

Graduate Coordinator: J. R. O'Malley

Prerequisite: The requirement for admission to the graduate program is a bachelor's degree in electrical engineering or a related field.

To help formulate a Ph.D. program, the Department of Electrical Engineering gives a preliminary examination over basic and advanced undergraduate subjects and some of the graduate subjects already taken by the student. This examination will be administered by a departmental committee and will be given, in general, during the first winter or spring quarter of attendance after the completion of the master's program.

The following *Engineering Common Courses* are available for graduate major credit: EGC 550—Direct Energy Conversion Engineering 1; EGC

551—Direct Energy Conversion Engineering 2; EGC 552—Direct Energy Conversion Engineering Laboratory.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

EE 510—Geometric Optics for Engineers. 3 credits
EE 513—Application of Digital Computers to Speech Research. 3 credits
EE 514—Automatic Speech Processing. 3 credits
EE 522—Transistor Electronics. 3 credits
EE 523—Transistor Electronics Laboratory. 1 credit
EE 524—Pulse Circuits Laboratory. 1 credit
EE 525—Pulse Circuits. 3 credits
EE 526—Application of Pulse Circuits. 3 credits
EE 527—Integrated Circuits. 4 credits
EE 528—Physical Electronics for Engineers 1. 4 credits
EE 529—Physical Electronics for Engineers 2. 4 credits
EE 551—Antenna Systems. 3 credits
EE 555—Microwave Laboratory. 1 credit
EE 556—Microwave Techniques. 4 credits
EE 558—Applications of Magnetism. 3 credits
EE 561—Digital Computer Principles 1. 4 credits
EE 562—Digital Computer Principles 2. 4 credits
EE 563—Digital Computer Principles 3. 4 credits
EE 570—Control System Theory and Practice. 3 credits
EE 571—Synthesis of Linear Controls. 3 credits
EE 581—Electric Energy System Instrumentation. 3 credits
EE 591—Special Topics in Electrical Engineering 1. 1 to 4 credits
Maximum 12 credits including EE 592.
EE 592—Special Topics in Electrical Engineering 2. 1 to 4 credits
Maximum 12 credits including EE 591.

GRADUATE COURSES

EE 600—Elements of Linear Systems. 3 credits
Linear systems. Fourier, Laplace, and Z-transform theory for periodic, aperiodic, and discrete signals in linear systems. Sampling theorems. Convolution, impulse response, transfer functions. Stability, causality, state variables.

EE 601—Advanced System Theory 1. 3 credits
Matrix theory required for the study of complex linearized dynamic systems and electric networks; stability theory; illustrative examples.

EE 602—Advanced System Theory 2. 3 credits
Prerequisite: EE 601. Further application of matrix methods to dynamic systems and electric networks; extension to discrete, nonlinear, and non-stationary systems. Markov processes.

EE 611—Physical Optics for Engineers 1. 3 credits
Prerequisites: MS 502, MS 503. Electromagnetic theory of light waves; Fresnel laws of reflection and refraction; light polarization and interference phenomena.

EE 612—Physical Optics for Engineers 2. 3 credits
Prerequisite: EE 611. Diffraction; theory of partial coherence of light; optics of metals; crystal optics.

EE 613—Laser Technology. 3 credits
Prerequisites: EE 611, PS 541. Stimulated emission processes and the design of laser systems.

EE 614—Electro-Optics. 3 credits
Prerequisite: PS 541. Crystal optics; interaction of light with matter; electro-optic and magneto-optic effects; non-linear optics; light modulation and detection; applications.

EE 615—Electrical Activity of the Nervous System. 3 credits
Prerequisite: MS 305, EE 333, or PS 415. Corequisite: ME 360 or PS 420. Analysis of the electrical signals of peripheral nerve and brain with application of systems engineering techniques.

EE 616—Biophysical Models of Nerve Impulse Propagation 3 credits
Prerequisite: EE 615 or consent of instructor. Analysis of chemical, electrical, hydrodynamic and solid-state models of axonic and synaptic nerve transmission.

EE 617—Semiconductor Physical Electronics 1. 3 credits
Prerequisite: EE 529. Crystal structures in semiconductors; imperfections; diffusion processes; lattice vibration spectra. Equilibrium properties of electrons and holes. One-electron energy band model.

EE 618—Semiconductor Physical Electronics 2. 3 credits
Prerequisite: EE 617. Electronic transport phenomena. Boltzmann's equation and the relaxation-time approximation. Transport coefficients in semiconductors. Scattering mechanisms. Recombination-generation and trapping processes.

EE 619—Semiconductor Physical Electronics 3. 3 credits
Prerequisite: EE 618. Excess carrier phenomena. Photoelectric effects in semiconductors. Optoelectronic devices. Metal-semiconductor devices. Metal-insulator-semiconductor (MIS) diodes. Thin-film devices.

EE 621—Semiconductor Junction Devices. 3 credits
Properties of semiconductors, transport of carriers; junction behavior; junction diodes and transistors; emphasis on approximations underlying device theory.

EE 622—Electronic Circuits 1. 3 credits
Prerequisite: Required undergraduate electronics sequence. Linear circuit models of transistors; properties of linear active circuits, gain bandwidth limitations and optimum performance of amplifiers; theory and design of feedback amplifiers; applications to transistor and integrated circuits.

EE 623—Electronic Circuits 2. 3 credits
Prerequisite: EE 622. Analysis and design of frequency-selective amplifiers; active RC circuits; harmonic and relaxation oscillators; applications to integrated circuits.

EE 624—Electronic Circuits 3. 3 credits
Prerequisite: EE 623. Piecewise linear analysis techniques in the determination of optimum or limiting performance of transistor switching, sweep, and discrete-state circuits; large signal transistor circuit models; applications to discrete and integrated digital circuits.

EE 625—Models and Applications of Solid-State Devices 1. 3 credits
Prerequisite: Typical undergraduate electronics sequence. Modeling as a vehicle to link physical processes with terminal behavior; semiconductors; thin-film resistors; field-effect transistors; MOS transistors; diodes; selected circuit applications.

EE 626—Models and Applications of Solid-State Devices 2. 3 credits
Prerequisite: EE 625. Diffusion, drift, and integrated-circuit transistors; com-

parison of Ebers-Moll, charge-control, and Linvill models; selected circuit applications.

EE 628—Fluctuation Phenomena 1. 3 credits

Prerequisite: EE 640. Theory with applications to electrical engineering. Sources of noise in devices; influence upon performance of circuits and systems; limitation of detectors and sensitive measuring instruments.

EE 629—Fluctuation Phenomena 2. 3 credits

Prerequisite: EE 628. Continuation of EE 628.

EE 630—Advanced Circuit Analysis. 3 credits

Network fundamentals; network characterization; frequency analysis; superposition integrals; signal-flow techniques; stability problems; real and imaginary relations.

EE 631—Generalized Network Theory. 3 credits

Prerequisite: EE 630 or EE 634. Networks which are not necessarily linear, lumped, passive and reciprocal. The gyrator. Extensions of classical methods to more general networks.

EE 632—Nonlinear Circuits. 3 credits

Prerequisite: EE 630 or EE 634. Analytical and topological approaches to nonlinear circuits; approximate solutions; nonlinear resonance; relaxation oscillations.

EE 634—Introduction to Network Synthesis. 3 credits

Network functions; impedance and frequency scaling; physical realizability; 2-terminal network synthesis methods.

EE 635—Modern Filter Synthesis. 3 credits

Prerequisite: EE 634. Insertion-loss synthesis of 4-terminal networks; frequency transformation; approximation problems; the potential analogy.

EE 636—Transfer Function Synthesis. 3 credits

Prerequisite: EE 634. Properties and realizability of 4-terminal networks. Synthesis of transfer functions with ladders, lattices and parallel-ladder networks. The prediction method.

EE 640—Noise in Linear Systems. 3 credits

Passage of electrical noise and signals through linear filters and systems. Statistical representation of random signals and electrical noise (time and ensemble averages of continuous random variables), autocorrelation, cross-correlation, and power spectral densities. Optimum linear communication systems, smoothing, and prediction.

EE 641—Theory of Communication 1. 3 credits

Prerequisite: EE 640. Filtering, modulation, and demodulation of signals corrupted by noise; passage of electrical noise and signals through nonlinear filters and systems.

EE 642—Theory of Communication 2. 3 credits

Prerequisite: EE 641. Optimum receiver principles; analysis of digital and analog communication systems in the presence of noise; modeling of communication channels.

EE 643—Signal Representation. 3 credits

Prerequisite: EE 641. Complex variable representation of signals and noise. Analytic and entire function theory in band-limited and time-limited signals. Sampling and orthogonal expansion of deterministic and stochastic signals.

EE 644—Signal Design. 3 credits

Prerequisites: EE 643, STA 612. Criteria of optimality in communication and ranging systems. Ambiguity functions. Chirp-type ranging signals; design of rang-

ing signals for extended targets. Generalized modulation theory by complex variable techniques.

EE 645—Statistical Decision Theory. 3 credits

Prerequisite: EE 640. Hypothesis testing of signals in the presence of noise by Bayes, Neyman-Pearson, minimax criteria; statistical estimation of signal parameters; optimum filters and receivers; ambiguity functions and inverse probability.

EE 646—Space Communications. 3 credits

Prerequisite: EE 641. Telemetering systems, space communication links, satellite communications systems, space tracking, and navigation systems.

EE 647—Information Theory. 3 credits

Quantitative measure of information and its properties; information sources, noiseless channels, and information compression; noisy channels and channel capacity; introduction to error-correcting codes.

EE 648—Error Correcting Codes. 3 credits

Algebraic coding theory; group, Hamming, Reed-Muller, Bose-Chaudhuri, Fire, and recurrent codes; and other burst-error correcting codes. Encoder and decoder implementation by linear feedback shift registers.

EE 649—Digital Signal Processing. 3 credits

Prerequisite: EE 640. Measurement and analysis of signals in noise and noise like signals. Digital spectral analysis by fast Fourier transform methods; nonstationary data analysis; applications of adaptive techniques; errors in measurement, analysis, and estimation.

EE 651—Electromagnetic Fields and Waves. 3 credits

Prerequisite: Undergraduate course in fields and waves. Electromagnetic theory applied to engineering including static field problems and propagation, reflection and guiding of electromagnetic waves.

EE 652—Antennas and Wave Propagation. 3 credits

Prerequisite: EE 651. Antenna systems and wave propagation in anisotropic media.

EE 653—Wave Propagation in Plasmas. 3 credits

Prerequisite: Undergraduate course in fields and waves. Electrical properties of plasma. Plasma oscillations. Propagation of electromagnetic, space-charge, and acoustic waves. Microwave diagnostics.

EE 655—Active Microwave Devices. 3 credits

Prerequisite: EE 651. Generation and amplification of microwaves, with emphasis on devices still in the research stage. Solid-state devices utilizing the Gunn effect (domain, quenched, and LSA modes), avalanche transit-time semiconductor diodes (IMPATT devices), acoustic wave amplification in solids, traveling-wave interaction in solids.

EE 656—Waveguides and Microwave Networks. 3 credits

Prerequisite: EE 651. Rectangular and cylindrical waveguides; resonant cavities. Microwave network theory; one-ports, two-ports, n-ports; scattering matrix. Directional couplers, magic tees, circulators.

EE 657—Coupled-Mode Theory. 3 credits

Prerequisite: Senior-level course in fields and waves. Theory of the coupled-mode formalism. Application to coupled linear oscillators, directional couplers, traveling-wave amplifiers, backward wave oscillators, distributed and lumped circuit parametric amplifiers.

EE 660—Foundations of Information Science. 3 credits

Prerequisites: EE 561, EE 562. Problems in information science; regular ex-

pressions; push-down automata; context-free languages; theory of algorithms; symbol manipulation; stochastic automata; associative memories; information storage and retrieval.

EE 661—Analysis and Synthesis of Combinatorial Switching Circuits. 3 credits

Prerequisite: EE 561. Boolean algebra; switching circuits; minimization techniques; multi-output and multi-level combinatorial circuits; threshold logic. Applications to computer and switching system design.

EE 662—Sequential Switching Circuit Design. 3 credits

Prerequisite: EE 661. The basic circuit model; timetable and problem statement; state diagram and flow table; equivalent states and merged flow table; secondary state assignment; output map and hazards elimination. Pulse, asynchronous, and linear sequential circuits.

EE 663—Introduction to Automata Theory—Finite-State Machines. 3 credits

Moore & Mealy model of finite-state machines, transition table, diagrams and matrices, equivalence and machine minimization, state identification and machine identification experiments, finite-memory machines, introduction to Turing machines.

EE 664—Pattern Recognition Theory 1. 3 credits

Decision functions; optimum decision criteria; distance functions; hyperplanes, hyperspheres, and hyperquadrics; k*th* nearest neighbor decision rule; clustering transformation; piecewise linear machines; estimation theory; Perceptron.

EE 665—Electronic Analog and Hybrid Computers 1. 3 credits

System design considerations for analog and hybrid computers. Simulation techniques.

EE 666—Electronic Analog and Hybrid Computers 2. 3 credits

Prerequisite: EE 665. Combined analog and digital computing systems. Performance comparison, mathematical models of hybrid systems. Error analysis and scaling in hybrid computers.

EE 667—Electronic Analog and Hybrid Computers 3. 3 credits

Prerequisites: EE 666, EE 640. Statistical measurement techniques, digital differential analyzers. Hybrid optimization techniques.

EE 668—Digital Systems Control. 3 credits

Prerequisite: EE 670. Sampling theorems, numerical analysis, number series, error analysis of digital systems, digital simulation, the digital computer as a control component.

EE 669—Pattern Recognition Theory 2. 3 credits

Prerequisite: EE 664. Feature extraction, kernel approximation; entropy functions; stochastic approximation; potential functions; learning algorithms; image feature sampling; discrete dynamic programming; threshold logic; grammars and lists in pattern recognition.

EE 670—Modern Control Theory 1. 3 credits

Prerequisite: EE 474. Systems theory from a mathematical point of view. Controllability and observability. Design of state observers. Realization of linear systems. Optimization of continuous and discrete systems with deterministic inputs by means of the calculus of variations and dynamic programming.

EE 671—Modern Control Theory 2. 3 credits

Prerequisites: EE 640, EE 670. Pontryagin's Maximum Principle. Optimization of systems with state and control variable constraints. Bang-bang control. The stochastic control problem. Kalman-Bucy filtering.

EE 672—Modern Control Theory 3. 3 credits
Prerequisite: EE 671. Computational techniques in control. Quasilinearization and invariant imbedding. Steepest descent and conjugate gradients. Second variations and neighboring extremal control.

EE 676—Inertial Guidance and Control. 3 credits
Prerequisite: EE 670. Modern navigational and vehicle guidance and control techniques based upon usage of inertial reference.

EE 679—Nonlinear Control Systems. 3 credits
Prerequisite: EE 570. Stability of discrete and continuous systems using the second method of Liapunov. The second method as a design tool. Popov stability. Wiener theory of nonlinear systems.

EE 680—Advanced Electric Energy Systems 1. 3 credits
Operation of power systems under static symmetrical conditions. Standard network models. Voltage, frequency, and power control. Economic and geographical constraints. Pooling. Optimum power scheduling.

EE 681—Advanced Electric Energy Systems 2. 3 credits
Prerequisite: EE 680. Operation of power systems under dynamic conditions. Dynamic models. Protective strategies and emergency routing schemes. High voltage DC.

EE 682—Advanced Electric Energy Systems 3. 3 credits
Prerequisite: EE 681. Computational aspects of system operation. Comparison of analog computer (including the network analyzer) with the digital computer as a design tool and an "on-line" device.

EE 685—Advanced Electrical Machinery. 3 credits
Electromechanical energy conversion. Applications of Lagrange's equation and Hamilton's principle to the evaluation of the characteristics and operation of physical devices.

EE 687—Advanced Electrical Measurements. 4 credits
Electrical standards including National Bureau of Standards traceability. Lectures and laboratory experience in modern practice of electrical measurements and data acquisition methods in complex systems.

EE 691—Special Topics in Electrical Engineering. 1 to 6 credits
Laboratory, lectures, and/or conferences covering specially selected topics in electrical engineering. May be repeated with change of content up to a maximum of 18 credits including EE 692.

EE 692—Special Topics in Electrical Engineering. 1 to 6 credits
Continuation of EE 691. May be repeated with change of content up to a maximum of 18 credits including EE 691.

EE 695—Graduate Seminar. 1 credit
Discussion of topics in fields of graduate study and research. May be repeated with change of content up to a maximum of 4 credits.

EE 699—Master's Research. 1 to 17 credits

EE 799—Doctoral Research. 1 to 17 credits

ELEMENTARY EDUCATION

GRADUATE FACULTY 1970-71

Olson, W., *Acting Chairman*; Ambrose, E. V.; Bernard, D. H.; Block, A. C.; Cooper, A. J.; Crews, R.; Ebbeck, F. K.; Fillmer, H. T.; Flan-

NERY, M. E.; HILLIARD, F. P.; KAPLAN, L.; NEWCOMB, A. P., JR.; PACKER, A. B.; SHEA, J. J.; SHECKLES, M. E.; TISON, J. P.; WENZEL, E. L.; YOUNG, G. M.

Graduate Coordinator: W. OLSON

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

EDE 500—SEMINAR IN ELEMENTARY EDUCATION 1. 4 credits
EDE 550—TEACHING OF MODERN MATHEMATICS. 4 credits
EDE 560—TEACHING OF SCIENCE IN THE ELEMENTARY SCHOOLS. 4 credits
EDE 575—TEACHING READING IN ELEMENTARY SCHOOL 1. 4 credits
EDE 576—TEACHING READING IN ELEMENTARY SCHOOL 2. 4 credits

GRADUATE COURSES

EDE 600—ELEMENTARY SCHOOL CURRICULUM. 4 credits

Prerequisite: ED 600 or a course in curriculum. Content and methods of the elementary school curriculum. Offered primarily for students who have not taken a course in elementary curriculum and who have had no teaching experience in the elementary schools.

EDE 601—PRACTICES IN ELEMENTARY EDUCATION. 4 credits

Prerequisite: Course background in elementary curriculum or teaching experience in the elementary school. Practices in the elementary school in relation to fundamental principles of curriculum development. Emphasizes selection, organization and development of effective teaching-learning situations.

EDE 603—EARLY CHILDHOOD EDUCATION 1. 4 credits

Trends in the teaching of nursery and kindergarten children as shown in past and current educational theory.

EDE 604—EARLY CHILDHOOD EDUCATION 2. 4 credits

Current organization patterns and program models affecting nursery and kindergarten curriculum.

EDE 608—MODELS FOR CURRICULUM ORGANIZATION AND INSTRUCTION. 4 credits

Prerequisite: EDE 601. Elementary school patterns; influence of these patterns as a determiner of educational program.

EDE 620—SOCIAL STUDIES EDUCATION—ELEMENTARY SCHOOL. 4 credits

Prerequisite: Graduate curriculum course. Contributions of social education to the total elementary school program, with emphasis on social interaction and programs and procedures in social studies area.

EDE 630—INDIVIDUAL WORK. 2 to 5 credits

For advanced students who wish to study individual problems in Elementary Education and/or Early Childhood Education under faculty guidance. May be repeated with change of content up to a maximum of 15 credits.

EDE 635—SUPERVISION OF PRE-SERVICE TEACHERS. 4 credits

Open to graduate students with certification and background in elementary education. Problems and issues of pre-service teacher education, with particular emphasis on procedures of supervising interns.

EDE 650—MATHEMATICS IN THE ELEMENTARY SCHOOL. 4 credits

Prerequisite: EDE 550. Recent research, patterns of curriculum, techniques of

teaching, and use of instructional media. Primarily for elementary teachers who desire specialization in mathematics education.

EDE 660—Science Education in the Elementary School. 4 credits
Prerequisite: EDE 361 or EDE 560. Current problems, new materials and teaching techniques, and research and recent developments in the sciences.

EDE 670—Language Arts in the Elementary School. 4 credits
Speaking, listening, writing, and language study in the elementary clasroom.

EDE 671—Early Childhood Language Arts and Reading. 4 credits
Prerequisite: EDE 370 or EDE 375. Factors influencing early language and their relationship to beginning school programs in listening, speaking, reading, and writing.

EDE 672—Children's Literature in the Elementary Curriculum. 4 credits
Prerequisite: EH 491. Evaluating, selecting, and using fiction, biography, poetry, and informational books for instructional, informational, and recreational purposes.

EDE 675—Trends in the Teaching of Reading. 4 credits
Prerequisite: A basic course in teaching reading. Trends in the teaching of reading analyzed by study of research; consideration of controversial issues involving classroom organization, methods, and materials.

EDE 690—Special Topics. 2 to 5 credits
Prerequisite: Permission of department chairman. May be repeated with change of content up to a maximum of 15 credits.

EDE 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EDE 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EDE 700—Problems in Elementary Education 1. 4 credits
Advanced course in elementary school curriculum.

EDE 701—Problems in Elementary Education 2. 4 credits
Continuation of EDE 700.

EDE 702—Evaluation in the Elementary School. 4 credits
Point of view, methods, and techniques used in appraising the behavioral growth of pupils; evaluation of the objectives of the total elementary school program.

EDE 703—Seminar in Elementary Education 2. 4 or 8 credits
Open to advanced graduate students. Current research and an overview of the total program in elementary education. May be repeated with change of content up to a maximum of 8 credits.

EDE 704—Seminar in Early Childhood Education. 2 to 8 credits
Open to advanced graduate students. Problems and issues in early childhood education. May be repeated with change of content up to a maximum of 8 credits.

ENGINEERING—GENERAL

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

EGC 508—Fundamentals of Radiation Protection. 4 credits
EGC 541—Tensor Fields and Fluid Dynamics. 3 credits
EGC 550—Direct Energy Conversion Engineering 1. 3 credits
EGC 551—Direct Energy Conversion Engineering 2. 3 credits

EGC 552—Direct Energy Conversion Engineering Laboratory. 1 to 3 credits

EGC 578—Nuclear Chemical Engineering. 3 credits

GRADUATE COURSES

EGC 601—Theory of Fluid Flow 1. 3 credits

Prerequisite: EGC 601 or consent of instructor. Concepts of velocity potential, ferential equations of motion, continuity, and state. Practical solutions for two- and three-dimensional flow.

EGC 602—Theory of Fluid Flow 2. 3 credits

Prerequisite: EGC 601 or consent of instructor. Concepts of velocity potential, stream function, and irrotational flow. Application of conformal transformations to two-dimensional flow.

EGC 603—Theory of Fluid Flow 3. 3 credits

Prerequisite: EGC 601 or consent of instructor. Differential equations of constant density viscous fluid flow and their exact and approximate solutions. Laminar and turbulent boundary layers. Magnetohydrodynamic effects.

EGC 604—Boundary Layer Theory. 4 credits

Prerequisite: EGC 603 or consent of instructor. Variable density laminar and turbulent boundary layers. Transformations to constant density flow. Integral methods. Mass transfer, diffusion, chemical reactions, extraneous effects.

EGC 605—Theories of Turbulent Flows. 3 credits

Prerequisite: EGC 601, MS 604 or EE 640, or consent of instructor. Mathematical theory of the turbulent motion of fluids. History and introduction to contemporary research in the statistical theory of turbulence.

EGC 611—High Speed Gas Dynamics 1. 3 credits

Subsonic flow, linear and nonlinear theories. Hodograph, integral, series, and relaxation methods.

EGC 612—High Speed Gas Dynamics 2. 3 credits

Prerequisite: EGC 611. Two-dimensional supersonic flow, method of characteristics. Axially symmetric supersonic flow, linear and nonlinear theories.

EGC 613—High Speed Gas Dynamics 3. 3 credits

Prerequisite: EGC 612. Multidimensional hypersonic flow. Mixed subsonic and supersonic flows. Transonic flow.

EGC 621—Surface Hydrology. 4 credits

Prerequisite: CE 522. Mechanics of the occurrence and distribution of water by natural processes including the global energy balance, precipitation, run-off, infiltration, and water losses. Catchment characteristics and hydrograph analysis.

EGC 622—Operational Hydrology 1. 4 credits

Prerequisite: EGC 621. Frequency analysis of hydrologic events. Hydrologic probability distributions. Analysis and synthesis of hydrologic data. Linear and nonlinear regression. Multivariate analysis of hydrologic signals.

EGC 623—Operational Hydrology 2. 4 credits

Prerequisite: EGC 622. Correlation and spectral analysis of hydrologic signals and systems. Application of linear systems theory to components of hydrologic cycle and total rainfall-runoff process. Criteria for hydrologic instruments and networks.

EGC 628—Water Science Seminar. 0 to 5 credits

Chemical, physical, and biological science of the behavior of natural waters

presented by specialists in these areas. May be repeated with change of content up to maximum of 9 credits.

EGC 630—Analytical Techniques for Engineers and Scientists 1. 3 credits

Prerequisites: MS 501, MS 502. Hilbert space, linear operators in Hilbert space, spectral analysis of self-adjoint and formally self-adjoint operators, generalized functions and applications.

EGC 631—Analytical Techniques for Engineers and Scientists 2. 3 credits

Prerequisite: EGC 630. Application of spectral theory of linear operators to differential equations, eigenfunction expansion, Green's function techniques, method of separation of variables, and integral transform techniques.

EGC 632—Analytical Techniques for Engineers and Scientists 3. 3 credits

Prerequisite: EGC 631. Application of spectral theory of linear operators to integral equations, asymptotic solutions and evaluation of integrals, perturbation methods, WKB method, variational methods, and Wiener-Hopf technique.

EGC 633—Principles of Engineering Analysis 1. 3 credits

Prerequisite: MS 501. Solution of ordinary differential equations with variable coefficients. Method of Frobenius, classification of singularities, integral representations of solutions. Treatment of classical equations of Bessel, Legendre, Hermite and Mathieu. Asymptotic solutions using the WBK method and saddle-point technique.

EGC 634—Principles of Engineering Analysis 2. 3 credits

Prerequisite: MS 501. General methods for solving partial differential equations of first and second order. Classification into hyperbolic, elliptic, and parabolic types. Reduction to canonical form. Equations of wave propagation, heat conduction, and Laplace. Treatment of initial and boundary value problems.

EGC 635—Principles of Engineering Analysis 3. 3 credits

Prerequisite: EGC 634. Dirichlet and Neumann boundary value problems. Green's function for Laplace's equation, conformal mapping, spherical harmonics. Solution of the Helmholtz, Poisson and biharmonic equations. Application to inviscid hydrodynamics, optical diffraction and gravitational potential theory.

EGC 636—Principles of Engineering Analysis 4. 3 credits

Prerequisite: MS 501. Solution of Volterra and Fredholm integral equations of the first and second kind. Inversion of self-adjoint operators via Green's function, properties of symmetric kernels, Hilbert-Schmidt theory, and the bilinear formula. Treatment of the singular integral equations of Abel and Carleman. Iteration and approximation techniques.

EGC 637—Principles of Engineering Analysis 5. 3 credits

Prerequisite: EGC 633. Solution techniques for nonlinear differential and integral equations. The equations of Riccati, van der Pol, and Hammerstein. Elliptic functions and Painlevé transcendents. Phase plane, singular points, limit cycles and stability of autonomous systems. Similarity transforms and singular perturbation theory applied to nonlinear partial differential equations arising in hydrodynamics.

EGC 638—Approximation Techniques in Engineering and Science 1. 3 credits

Prerequisite: EGC 632. Asymptotic solutions of differential and integral equations, geometrical theory of diffraction, regular and singular perturbations, WBK method, and variational methods.

EGC 639—Approximation Techniques in Engineering and Science 2. 2 credits
Prerequisite: EGC 632. Krylov-Bogoliubov-Whitham's averaging technique for nonlinear differential equations. Chapman-Enskog's and Grad's approximate solution of Boltzmann equation; other approximation techniques.

EGC 671—Introduction to Plasmas. 3 credits
Prerequisites: PS 300, MS 505. Nomenclature, materials, and plasma devices, fundamentals of plasma kinetic theory, low and high pressure discharges, technical applications.

EGC 672—Plasma Theory. 4 credits
Prerequisite: EGC 671. Microscopic and macroscopic foundations of plasma theory. Individual motion of charged particles and macroscopic plasma motion in an electromagnetic field. Nonequilibrium states and relaxation processes. Waves and instabilities.

EGC 675—Plasma Laboratory. 4 credits
Laboratory practice in use of equipment and determination of basic parameters of plasmas.

EGC 677—Gas Lasers and Their Engineering Applications. 4 credits
Prerequisites: PS 340, NES 470. Introduction to theory of gas lasers. Laser design; extensive coverage of applications of gas lasers.

EGC 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EGC 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

ENGINEERING SCIENCE AND MECHANICS

GRADUATE FACULTY 1970-71

Nevill, G. E., Jr., *Chairman;* Boykin, W. H., Jr.; Burns, J. J., Jr.; Cristescu, N.; Ebcioglu, I. K.; Edson, C. G.; Eisenberg, M. A.; Grinter, L. E.; Hartley, C. S.; Hemp, G. W.; Kurzweg, U. H.; Lindgren, E. R.; Lu, S. Y.; Malvern, L. E.; Sheppard, D. M.; Sierakowski, R. L.; Walsh, E. K.

Graduate Coordinator: U. H. Kurzweg

The requirement for admission to the graduate program is a bachelor's degree in engineering sciences or in a related field of engineering or the physical sciences.

Students taking 500-level courses for graduate major credit will be required to do additional reading, problems, and reports.

The following *Engineering Common Courses* are available for graduate major credit: EGC 541—Tensor Fields and Fluid Dynamics; EGC 601—Theory of Fluid Flow 1; EGC 602—Theory of Fluid Flow 2; EGC 603—Theory of Fluid Flow 3; EGC 604—Boundary Layer Theory; EGC 605—Theories of Turbulent Flows; EGC 611—High Speed Gas Dynamics 1; EGC 612—High Speed Gas Dynamics 2; EGC 613—High Speed Gas Dynamics 3;

EGC 630—Analytical Techniques for Engineers and Scientists 1; EGC 631—Analytical Techniques for Engineers and Scientists 2; EGC 632—Analytical Techniques for Engineers and Scientists 3; EGC 633—Principles of Engineering Analysis 1; EGC 634—Principles of Engineering Analysis 2; EGC 635—Principles of Engineering Analysis 3; EGC 636—Principles of Engineering Analysis 4; EGC 637—Principles of Engineering Analysis 5; EGC 638—Approximation Techniques in Engineering and Science 1; EGC 639—Approximation Techniques in Engineering and Science 2.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ESM 520—Fundamental Vibration Analysis. 3 credits
ESM 527—Modern Techniques of Structural Dynamics. 3 credits
ESM 530—Individual Study 1. 1 to 9 credits. Maximum 9 credits
ESM 533—Advanced Mechanics of Solids and Structures. 3 credits
ESM 534—Elevated Temperature Stress Analysis. 3 credits
ESM 536—Intermediate Dynamics. 3 credits

GRADUATE COURSES

ESM 601—Introduction to Continuum Mechanics 1. 3 credits
Prerequisites: ESM 303 or ESM 305; MS 502. Tensor properties of stress and strain. Cartesian tensors. Equations of motion and compatibility.

ESM 602—Introduction to Continuum Mechanics 2. 3 credits
Prerequisite: ESM 601. Relations between stress, strain, and strain rate for elastic, plastic, and viscous solids; also for compressible and viscous fluids. Thermodynamics of continua.

ESM 603—Advanced Continuum Mechanics. 3 credits
Prerequisite: ESM 602. Comprehensive, unified treatment of the mathematical theories of solid and fluid mechanics, including gases.

ESM 605—Principles of Mechanics in Biomedical Engineering. 3 credits
Prerequisites: ESM 601 or ESM 602; ESM 533 or ESM 634. Rheological behavior of biological materials subject to steady-state and dynamic loading. Mathematical models and analytical techniques used in the biosciences. Experimental techniques for material property investigation of representative body tissues.

ESM 621—Theory of Structural Vibrations 1. 3 credits
Prerequisite: ESM 520. Lagrange's Equations. Multiple degree of freedom systems. Free and forced motions. Normal coordinates. Effect of damping. Use of matrix methods, computers, Rayleigh-Ritz and other approximate techniques.

ESM 622—Theory of Structural Vibrations 2. 3 credits
Prerequisite: ESM 621. Longitudinal and torsional vibrations of bars, lateral vibrations of bars, membranes, and plates. Normal mode, lumped parameter, and transformation methods. Transmission and reflection of stress waves in isotropic elastic media.

ESM 623—Nonlinear Vibrations 1. 3 credits
Prerequisite: ESM 520 or ESM 621. Phase plane and singular point methods. Limit cycles. Method of averaging. Application to one degree of freedom autonomous and nonautonomous systems. Nonlinear resonance. Stability of solutions. Parametrically excited systems. Method of perturbations.

ESM 624—Nonlinear Vibrations 2. 3 credits
Prerequisite: ESM 623. Multiple degree of freedom systems. Averaging and perturbations. Systems with slowly varying parameters. Nonlinear continuous systems.

ESM 625—Random Vibrations 1. 3 credits
Prerequisite: ESM 621. Statistical analysis, response of discrete single and multiple degree of freedom dynamical systems to stationary random forces and parametric excitation. Extension to continuous systems and non-stationary excitation. Applications to engineering problems.

ESM 628—Modern Techniques of Structural Dynamics. 3 credits
Prerequisites: ESM 527, ESM 621. Modelling of complex structural systems occurring in aeronautical, mechanical, and structural engineering. Response of such systems to impulse, shock, and random excitations, emphasizing computer techniques.

ESM 634—Introduction to Elasticity. 3 credits
Prerequisites: ESM 303 or ESM 305; MS 501. Theory of stress and strain for continuous media. Stress and strain relations of elasticity. Strain energy density. Compatibility equations. Elementary three-dimensional problems. Plane elasticity in Cartesian and polar coordinates. Torsion of noncircular bars.

ESM 635—Introduction to Plates and Shells. 3 credits
Prerequisites: ESM 303 or ESM 305; MS 501. Small-deflection theory of plates. Boundary conditions. Rectangular and circular plates. Energy methods. Large deflections of plates. Orthogonal curvilinear coordinates. Surfaces of shells. Membrane theory of shells. Bending of shells of revolution.

ESM 636—Numerical Methods of Engineering Analysis 1. 3 credits
Prerequisites: ESM 634, ISE 351. Variational principles. Minimum potential energy. Relaxation, Rayleigh-Ritz and Galerkin methods. Modern computer techniques.

ESM 637—Numerical Methods of Engineering Analysis 2. 3 credits
Prerequisite: ESM 636. Trefftz's procedure. Prager's function space concept. Perturbation and collocation procedures. Use of computer.

ESM 642—Advanced Mechanical Metallurgy 3. 3 credits
Identical with MTL 642. Prerequisite: MTL 641. Continuum theory of dislocation. Stress fields, displacement fields, and energies of simple shapes and finite arrays of dislocations. Continuous distributions of dislocations and their relationship to mechanical properties. Relation of the state of dislocation to the geometry of deformed lattices.

ESM 644—Advanced Dynamics 1. 3 credits
Prerequisite: ESM 536. Dynamics of particles and rigid bodies applied to advanced engineering problems utilizing variational and transformation principles.

ESM 645—Advanced Dynamics 2. 3 credits
Prerequisite: ESM 644. Theory and application of Lagrangian equations to engineering problems. Hamilton-Jacobi theory and its applications.

ESM 646—Stability of Dynamical Systems. 3 credits
Prerequisite: ESM 520 or ESM 536. Basic concepts of stability, stability and asymptotic behavior of motion. Forced oscillations of systems with nonlinear characteristics. Floquet theory, Mathieu and Hill equations, Liapunov's direct method, criterion of Routh-Hurwitz, Popov and others.

ESM 649—Experimental Stress Analysis 1. 3 credits
Prerequisites: ESM 634, ESM 670. Theory and application of experimental techniques to problems of elasticity and plasticity.

ESM 650—Experimental Stress Analysis 2. 3 credits
Prerequisite: ESM 649. General optical theory of propagation of light in anisotropic media. Three-dimensional photoelasticity; theory and applications.

ESM 651—Experimental Stress Analysis 3. 3 credits
Prerequisite: ESM 650. Moire method, two- and three-dimensional applications. Mathematical theory of similitude and model analysis.

ESM 652—Theory of Elasticity 1. 3 credits
Prerequisites: ESM 601, ESM 634. Linear theory of homogeneous, isotropic, elastic media. Analysis of stress and strain. Nonlinear considerations.

ESM 653—Theory of Elasticity 2. 3 credits
Prerequisite: ESM 652. Tensor development of stress-strain laws and basic equations of elasticity. Two-dimensional problems. Energy and variational methods.

ESM 654—Theory of Elasticity 3. 3 credits
Prerequisite: ESM 653. Two-dimensional problems and their solutions by complex variable methods. Three-dimensional problems including torsion, bending, stress concentration, thermal stress, and stress-wave propagation.

ESM 655—Introduction to Theory of Thermal Stresses. 3 credits
Prerequisites: ME 430, ESM 534. Theory of thermal distortion and induced thermal stresses. Strain energy principles. Two- and three-dimensional problems. Creep. Thermal instability.

ESM 656—Theory of Thermal Stresses. 3 credits
Prerequisites: ESM 654, ESM 655. Uncoupled and coupled thermoelastic theory. Formulations of thermoelastic problems. Thermal stresses in structural elements. Thermoelastic stability. Analysis of thermal stresses in inelastic systems. New trends of analysis.

ESM 660—Properties of Materials. 3 credits
Prerequisite: ESM 533. Mechanical and thermodynamic analysis of the properties of materials. Creep, fatigue, stress relaxation characteristics; thermal cycling response; mechanical properties at elevated temperatures.

ESM 667—Theory of Elastic Stability 1. 3 credits
Prerequisite: ESM 635. Basic concepts and treatment of stability problems. Stability criteria. Elastic stability of bars and frames. Inelastic buckling of columns. Stability of plates under various loadings. Postbuckling behavior of plates. Plastic buckling.

ESM 668—Theory of Elastic Stability 2. 3 credits
Prerequisite: ESM 667. Elastic stability of cylindrical, conical, spherical, and shallow shells. Buckling of stiffened shells. Plastic stability and postbuckling deformation of shells. Plates and shells under dynamic loading. Buckling of nonconservative systems.

ESM 670—Introduction to Inelastic Behavior of Materials. 3 credits
Prerequisites: ESM 303 or ESM 305; MS 501. Fundamental inelastic theory including plasticity and viscoelasticity. Applications to beams, bars, rings, and plates. Dynamic inelastic effects. Problems in creep and stress relaxation.

ESM 671—Theory of the Inelastic Continuum 1. 3 credits
Prerequisites: ESM 601, ESM 670. Stress and strain in inelastic media. Flow, deformation, and incremental theories. Ideally plastic media.

ESM 672—Theory of the Inelastic Continuum 2. 3 credits
Prerequisite: ESM 671. Flow in strain hardening materials. Wave propagation in inelastic materials. Theory of metal forming processes.

ESM 673—Theory of Plates and Shells 1. 3 credits
Prerequisities: ESM 303 or ESM 305, ESM 635. Fundamental equations for the bending and stretching of thin plates with small deformations. Large deformations of plates with nonlinear considerations.

ESM 674—Theory of Plates and Shells 2. 3 credits
Prerequisite: ESM 673. Energy methods applied to plate problems. Thermal stresses in plates. General theory of deformation of thin shells.

ESM 675—Theory of Plates and Shells 3. 3 credits
Prerequisite: ESM 674. Large deformation theories for thin shells. Application of various approximate shell theories to engineering problems.

ESM 676—Inertial Guidance and Control. 3 credits
Identical with EE 676. Prerequisite: EE 670. Modern navigational and vehicle guidance and control techniques based on use of inertial reference.

ESM 677—Mathematical Theory of Control Systems 1. 3 credits
Prerequisite: EGC 630. Functional analysis of structure of linear dynamical systems. Discrete and continuous, lumped and distributed parameter systems. Application of the theory of minimum-normed operators to optimal-control-system problems. Projection theorems with applications in optimal control and estimation.

ESM 679—Nonlinear Control Systems. 3 credits
Identical with EE 679. Prerequisite: EE 570. Stability of discrete and continuous systems using the second method of Liapunov. Second method as a design tool. Popov stability. Wiener theory on nonlinear systems.

ESM 690—Graduate Seminar. 1 credit
Discussions and presentations in the fields of graduate study and research. May be repeated with change of content up to a maximum of 10 credits.

ESM 692—Special Topics in Engineering Mechanics. 1 to 9 credits
May be repeated with change of content up to a maximum of 18 credits.

ESM 699—Master's Research. 1 to 17 credits

ESM 799—Doctoral Research. 1 to 17 credits

ENGLISH

GRADUATE FACULTY 1970-71

Morris, A. C., *Acting Chairman*; Algeo, J. T.; Bigelow, G. E.; Bowers, R. H., Jr.; Bryan, R. A.; Childers, W. C.; Cox, E. H.; Crews, H. E.; Deakin, M. F.; Dwyer, R. A.; Fain, J. T.; Frazer, W. L.; Hellstrom, W.; Herbert, T. W.; Kirkland, E. C.; Kirkpatrick, M. S.; Lisca, P.; Murphree, A. A.; New, M.; Oras, A.; Pickard, J. B.; Robinson, W. R.; Roscelli, W. J.; Spivey, H. E.; Stryker, P. D.; Thurston, P. T.; Waldo, T. R.; Williams, A. L.

Graduate Coordinator: G. E. Bigelow

The English Department offers graduate work leading to the degrees of Doctor of Philosophy, Master of Arts, and Master of Arts in Teaching. Beginning students should have completed an undergraduate English major of at least 36 quarter hours, or its equivalent. Such a major should include courses in the important periods of English and American literature and the history of

the English language. Adequate preparation in such closely related fields as history, philosophy, and foreign language is presupposed. Entrance into doctoral study presumes the Master of Arts degree, or equivalent.

The Doctor of Philosophy requires a minimum of 67 quarter hours of course work beyond the baccalaureate, of which up to 18 quarter hours may be in a minor field; EH 685; functional knowledge of one foreign language, ancient or modern, or reading knowledge of two foreign languages; qualifying examination over three periods of English or American language and literature; dissertation (EH 799 minimum credit, 33 quarter hours); ASC 642; final oral examination. A concentration in study for this degree is possible in the following fields of language and literature: Linguistics, Medieval, Renaissance, Restoration and 18th Century, Nineteenth Century British, American to 1900, Contemporary British and American. Doctoral study in linguistics is also available in an interdisciplinary degree program involving the departments of Anthropology, English, Germanic and Slavic Languages and Literatures, Romance Languages and Literatures, and Speech.

The Master of Arts is offered in two options, each requiring 48 quarter hours of course credit. (A) *Thesis Option*: 36 quarter hours of English; EH 685; a research thesis (EH 699 minimum credit, 8 quarter hours); reading knowledge of one foreign language, ancient or modern; oral examination. (B) *Non-thesis Option*: 45 quarter hours of English; EH 685; reading knowledge of one foreign language, ancient or modern; comprehensive written examination. Eight quarter hours in a minor field may be substituted for 8 quarter hours of English in either of the above options. A Master of Arts program with emphasis on creative writing is also available. In this program, the student should enroll for 8 quarter hours of EH 530 and submit a creative thesis in lieu of the research thesis.

The Master of Arts in Teaching requires 54 quarter hours of course credits: 32 quarter hours in English; EH 685; 9 quarter hours in education; 9 quarter hours internship in college teaching; reading knowledge of one foreign language, ancient or modern; comprehensive written examination. One version of the Master of Arts in Teaching is designed to prepare those who wish to teach English as a second language.

Linguistics courses listed under the prefix LIN are available for graduate credit to English majors. With the approval of the Graduate Coordinator, graduate study in folklore is available by registration in EH 686. Questions concerning details of these programs should be referred to the Graduate Coordinator.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

EH 530—Individual Work in Creative Writing. 4 credits
EH 599—Special Study in English. 1 to 5 credits

GRADUATE COURSES

Courses offered through the program in Linguistics with the prefix LIN may also be used as part of a graduate program in English.

EH 601—HISTORY OF THE ENGLISH LANGUAGE. 4 credits
The origins and development of the English language.

EH 602—THE STRUCTURE OF PRESENT-DAY ENGLISH. 4 credits

EH 603—OLD ENGLISH: LANGUAGE. 4 credits
Old English grammar and reading from selected texts.

EH 604—MIDDLE ENGLISH: LANGUAGE. 4 credits
Middle English grammar and reading from selected texts.

EH 610—THE LITERATURE OF IRELAND. 4 credits
Beginning with the bardic tradition and the young Irish movement and emphasizing the major writers of the Irish Renaissance, such as Yeats, Synge, Joyce, O'Casey.

EH 611—20TH-CENTURY ENGLISH LITERATURE. 4 credits
Intensive examination of representative authors.

EH 612—BRITISH AND AMERICAN DRAMA OF THE 20TH-CENTURY. 4 credits
Modern drama in England, Ireland, and America.

EH 621—OLD ENGLISH: LITERATURE. 4 credits
Old English literary types and schools.

EH 622—BEOWULF. 4 credits

EH 623—MIDDLE ENGLISH: LITERATURE. 4 credits
Prerequisite: Course in Chaucer at 400 or 500 level.

EH 624—CHAUCER: *Troilus and Criseyde.* 4 credits
Reading and critical study of *Troilus and Criseyde* and the minor poems.

EH 625—CHAUCER: *The Canterbury Tales.* 4 credits

EH 631—THE RENAISSANCE IN ENGLAND: THE TUDOR PERIOD. 4 credits
Non-dramatic English literature from the accession of Henry VII to the death of Queen Elizabeth.

EH 632—THE RENAISSANCE IN ENGLAND: THE LATER RENAISSANCE. 4 credits
Non-dramatic English literature from the accession of James I to the Restoration.

EH 634—MILTON. 4 credits

EH 635—SPENSER. 4 credits

EH 636—PRE-SHAKESPEAREAN DRAMA: BEGINNINGS THROUGH MARLOWE. 4 credits
The classical background; a survey of biblical plays, folk plays, moralities, and interludes; the classical revival and the University Wits.

EH 637—LATE RENAISSANCE DRAMA: FROM MARLOWE TO THE CLOSING OF THE THEATRES. 4 credits
Plays by Dekker, Massinger, Jonson, Beaumont, Fletcher, Chapman, Ford, Middleton, Shirley, Brome.

EH 638—SHAKESPEARE: THE EARLY PLAYS. 4 credits
The early comedies, histories, and tragedies.

EH 639—SHAKESPEARE: THE LATER PLAYS. 4 credits
The late comedies, histories, and tragedies.

EH 641—THE AGE OF DRYDEN AND POPE. 4 credits
Prose, poetry, and drama in the period 1660 to 1744.

EH 642—THE AGE OF JOHNSON. 4 credits
Poetry, prose, and drama from 1744 to 1798.

EH 644—RESTORATION DRAMA. 4 credits

Plays by Dryden, Etherege, Wycherley, Otway, Vanbrugh, Congreve, and others.

EH 645—18TH-CENTURY DRAMA. 4 credits
The English stage from Addison to Sheridan.

EH 651—ROMANTICISM: BURNS, BLAKE, COLERIDGE, WORDSWORTH, SOUTHEY. 4 credits

EH 652—ROMANTICISM: BYRON, SHELLEY, KEATS, HUNT, SCOTT. 4 credits

EH 661—THE VICTORIAN PERIOD: POETRY. 4 credits

EH 662—THE VICTORIAN PERIOD: NON-FICTIONAL PROSE.

EH 671—AMERICAN LITERATURE: COLONIAL AND EARLY NATIONAL. 4 credits

EH 672—AMERICAN LITERATURE: HAWTHORNE THROUGH WHITMAN. 4 credits

EH 673—AMERICAN LITERATURE: TWAIN THROUGH DREISER. 4 credits

EH 674—AMERICAN LITERATURE: SINCE WORLD WAR I. 4 credits

EH 680—THE ENGLISH NOVEL: DEFOE TO SCOTT. 4 credits

EH 681—THE ENGLISH NOVEL: AUSTEN TO CONRAD. 4 credits

EH 682—LITERARY CRITICISM: CLASSICAL THROUGH RENAISSANCE. 4 credits

EH 683—LITERARY CRITICISM: 18TH-CENTURY TO PRESENT. 4 credits

EH 684—PROSODY. 4 credits

EH 685—BIBLIOGRAPHY AND METHODS OF RESEARCH. 4 credits

EH 686—INDIVIDUAL WORK.* 4 credits
Prerequisite: Approval of department chairman. For graduate students majoring in English and needing work in subjects not available in currently offered courses. Limited to small groups in actual residence.

EH 697—SUPERVISED RESEARCH. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EH 698—SUPERVISED TEACHING. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EH 699—MASTER'S RESEARCH. 1 to 17 credits

EH 701—SEMINAR IN LINGUISTICS.* 4 credits

EH 711—SEMINAR IN 20TH-CENTURY ENGLISH LITERATURE.* 4 credits

EH 712—SEMINAR IN CONTEMPORARY ENGLISH AND AMERICAN LITERATURE: VARIABLE TOPICS.* 4 credits

EH 721—SEMINAR IN MEDIEVAL LITERATURE.* 4 credits
Topics embrace Old English literature and Middle English literature including Chaucer.

EH 731—SEMINAR IN SHAKESPEARE.* 4 credits

EH 732—SEMINAR IN RENAISSANCE LITERATURE.* 4 credits

EH 741—SEMINAR IN RESTORATION AND EARLY 18TH-CENTURY LITERATURE.* 4 credits

EH 742—SEMINAR IN LATE 18TH-CENTURY LITERATURE.* 4 credits

EH 751—SEMINAR IN ROMANTICISM.* 4 credits

EH 761—SEMINAR IN VICTORIAN LITERATURE.* 4 credits

EH 771—SEMINAR IN 19TH-CENTURY AMERICAN LITERATURE.* 4 credits

EH 772—SEMINAR IN 20TH-CENTURY AMERICAN LITERATURE.* 4 credits

EH 773—SEMINAR IN AMERICAN LITERATURE: VARIABLE TOPICS.* 4 credits

EH 781—SEMINAR IN ENGLISH DRAMA.* 4 credits

EH 799—DOCTORAL RESEARCH. 1 to 17 credits

* May be repeated with change of content up to a maximum of 12 credits.

ENTOMOLOGY AND NEMATOLOGY

GRADUATE FACULTY 1970-71

EDEN, W. G, *Chairman*; BARANOWSKI, R. M.; BLANTON, F. S.; BROGDON, J. E.; BROOKS, R. F.; BUTLER, J. F.; CROMROY, H. L.; GILBERT, I. H.; GREENE, G. L.; HABECK, D. H.; HETRICK, L. A.; KERR, S. H.; KRAMER, S.; KUITERT, L. C.; LABRECQUE, G. C.; LLOYD, J. E.; LOWE, R. E.; MORGAN, P. B.; MUMA, M. H.; MURPHEY, M.; NATION, J. L.; PATTERSON, R. S.; PERRY, V. G.; RHOADES, H. L.; ROBINSON, F. A.; SIMANTON, W. A.; SMART, G. C., JR.; SMITH, W. W.; SMITTLE, B. J.; WAITES, R. E.; WALKER, T. J.; WEIDHAAS, D. E.; WESTFALL, M. J.; WHITCOMB, W. H.; WILKINSON, R. C.; WOLFENBARGER, D. O.

Graduate Coordinator: V. G. PERRY

The Department of Entomology and Nematology offers major work leading to the Master of Agriculture, Master of Science, and Doctor of Philosophy degrees in entomology and nematology. The staff is qualified to direct graduate study in all the principal areas of entomology and nematology; however, it is particularly strong in economic and taxonomic nematology and in economic, taxonomic, forest, and medical entomology, structural pest control, apiculture and physiology, ecology and behavior. Minor work is offered to students taking major work in other departments.

Prerequisites to graduate training in entomology include background in biology, chemistry, physics, and mathematics.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

EY 518—TROPICAL ENTOMOLOGY. 4 credits

EY 522—TROPICAL NEMATOLOGY. 5 credits

GRADUATE COURSES

EY 603—PROBLEMS IN ENTOMOLOGY. 1 to 5 credits

Problem for study selected in entomological or nematological specialization, including histology, morphology, physiology, taxonomy, embryology, biological control, ecology, toxicology, plant quarantine, commercial entomology, life history and habits, biology, and medical and veterinary entomology. May be repeated with change of content up to a maximum of 9 credits.

EY 607—INSECT TAXONOMY. 5 credits

Prerequisites: EY 408, EY 460, EY 608. Systems of classification, the basis of systematic entomology, and rules of nomenclature. Practice in identification of immature and adult insects in the field and laboratory.

EY 608—COMPARATIVE ANATOMY OF THE HEXAPODA. 5 credits

Prerequisite: EY 408. Comparative study of the external and internal anatomy of representative insects in each insect order.

EY 611—SPECIAL TOPICS IN ENTOMOLOGY AND NEMATOLOGY. 1 credit

Reports and discussions pertaining to selected topics announced in advance. May be repeated with change of content up to a maximum of 4 credits.

EY 612—Insect Physiology. 5 credits
Prerequisites: EY 608, BCH 511, BCH 513. Physiological study of the various organs and tissues of insects.

EY 615—Insect Behavior. 5 credits
Prerequisite: EY 612. Principles of animal behavior as they apply to insects. Reproductive, feeding, defensive, migratory, and social behavior of insects. Field and laboratory techniques.

EY 616—Insect Ecology. 5 credits
Prerequisite: EY 612. Interrelations of insects and their physical and biotic environment. Population dynamics and control of population size. Field and laboratory techniques.

EY 618—Insect Toxicology. 5 credits
Prerequisites: EY 405, CY 362, CY 363. Insecticides and acaricides: structure, toxic action, metabolism, hazards, residues in relation to health. Acquired resistance to pesticides. Research methods in toxicology.

EY 620—Medical Entomology. 5 credits
Prerequisite: EY 420. Arthropods (except mosquitoes) parasitic on man: collection, identification and bionomics of local species.

EY 621—Mosquitoes. 5 credits
Prerequisite: EY 420. Mosquitoes: collection, identification, bionomics and relationship to the health of man.

EY 622—Biological Control of Insects. 5 credits
Prerequisite: EY 301. Principles involved in the natural and biological control of insects.

EY 623—Immature Insects. 5 credits
Prerequisite: EY 460. Structure and identification of immature forms of insects, especially the Holometabola. An insect collection determined to family is required.

EY 624—Acarology. 5 credits
Prerequisite: EY 301. Morphology, phylogeny, taxonomy, and economic importance of mites.

EY 625—Techniques in Medical Entomology. 5 credits
Demonstration and use of modern techniques, equipment, and procedures in research on insects of medical importance. Conducted principally in the U.S.D.A. Entomology Research Laboratory.

EY 626—Aquatic Insects. 5 credits
Prerequisite: EY 460. Life histories and ecologies of aquatic insects.

EY 630—Plant Parasitic Nematodes. 5 credits
Identical with PT 630. Prerequisite: EY 303. Morphology, taxonomy, life cycles, pathogenicity, and control of the plant parasitic nematodes.

EY 631—Morphology and Physiology of Nematodes. 5 credits
Prerequisite: EY 303. Anatomical study of the organs of nematodes and their vital functions.

EY 632—Taxonomy of Nematodes. 5 credits
Prerequisite: EY 631. Taxonomy and identification of members of the Phylum Nematoda.

EY 634—Radiation in Insect Studies. 5 credits
Prerequisite: BLY 565. Specialized topics and current research on radiation in entomology.

EY 635—Insect Resistance to Crop Plants 1. 3 credits
Principles of plant resistance to insects.

EY 636—Insect Resistance to Crop Plants 2. 3 credits
Methods of developing plant resistance to insects.

EY 637—Veterinary Entomology. 5 credits
Prerequisite: EY 420 or consent of instructor. Arthropods parasitic on animals: biology, control, and host arthropod interaction. Collection, identification, and bionomics of arthropods affecting animals other than man.

EY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EY 699—Master's Research. 1 to 17 credits

EY 799—Doctoral Research. 1 to 17 credits

ENVIRONMENTAL ENGINEERING SCIENCES

GRADUATE FACULTY 1970-71

Pyatt, E. E., *Chairman;* Bevis, H. A.; Bolch, W. E., Jr.; Brezonik, P. L.; Dunavant, B. G.; Fox, J. L.; Furman, T. deS.; Heaney, J. P.; Huber, W. C.; Mauderli, W.; Morgan, W. H.; Odum, H. T.; Putnam, H. D.; Sholtes, R. S.; Singley, J. E.

Graduate Coordinator: H. A. Bevis

Graduate study is offered leading to the degrees of Master of Engineering, Master of Science in Engineering, Engineer, and Doctor of Philosophy in the field of environmental engineering sciences. Areas in which the student may specialize include air resources, water supply and water pollution control, water resources planning by systems analysis, environmental biology, water chemistry, radiological health, solid wastes, and systems ecology.

Separate programs in *Environmental Engineering Sciences* and *Environmental Engineering* are offered. Direct admission into the *Environmental Engineering Sciences* program requires a bachelor's degree in engineering or in a basic science such as chemistry, physics, biology or mathematics. Persons with a degree in a nontechnical field may also be admitted into this program upon the completion of specified articulation work.

Direct admission into the *Environmental Engineering* program requires that the student be a graduate engineer. Other persons wishing to enter this program will be required to take articulation work sufficient to bring their backgrounds into substantial agreement with those with undergraduate engineering training. To qualify for a master's degree in the Environmental Engineering program at least half of the candidate's required courses will be "engineering" in nature as contrasted to "science" courses. The specific program of study for each student must be approved by his supervisory committee.

It normally requires one calendar year to complete the requirements for a master's degree. If articulation work is required, it may take longer depending upon the extent of the student's deficiency.

The following *Engineering Common Courses* are available for graduate major credit: EGC 621—Surface Hydrology; EGC 622—Operational Hydrology 1; EGC 623—Operational Hydrology 2; EGC 628—Water Science Seminar.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ENE 500—Treatment of Wastewater. 4 credits
ENE 501—Industrial Waste Treatment. 3 credits
ENE 520—Environmental Biology. 4 credits
ENE 522—Environmental Engineering. 3 credits
ENE 531—Water and Wastewater Analysis. 4 credits
ENE 534—The Chemistry of Water Treatment. 5 credits
ENE 591—Special Topics in Environmental Engineering 1. 1 to 5 credits
ENE 592—Special Topics in Environmental Engineering 2. 1 to 5 credits

GRADUATE COURSES

ENE 600—Advanced Waste Treatment Operations. 5 credits
Prerequisite: ENE 500. Biological, physical, and chemical processes used in the treatment of wastewater. Development of design parameters and operating procedures based on experimentally derived data.

ENE 601—Advanced Environmental Engineering Design 1. 5 credits
Prerequisite: ENE 600. Layout and design of sanitary sewerage systems, pumping stations, force mains, wastewater treatment plants, and methods of effluent disposal. Design parameters, cost, and financing.

ENE 602—Advanced Environmental Engineering Design 2. 5 credits
Development of water supplies, layout and design of distribution systems, pumping and storage facilities, and water treatment plants. Design parameters, cost, and financing.

ENE 611—Water Quality Management. 3 credits
Prerequisite: ENE 500. Water quality management applied to streams, lakes, and tidal estuaries and embayments. Influence and effects of municipal and industrial wastes on public water supplies, shellfish, storage, recreational uses, industrial uses, and wildlife.

ENE 612—Water Management Seminar. 0 to 5 credits
Emerging problems and the control of water in the environment. Needs for new and better technology and institutional arrangements for the management of water. May be repeated with change of content up to a maximum of 9 credits.

ENE 613—Environmental Resource Systems. 4 credits
Prerequisite: Consent of instructor. Standards and criteria for evaluation of environmental resources projects. Formulation of mathematical models and environmental problems. Application of systems engineering and operations research as aids in decision-making.

ENE 614—Advanced Water Supply Engineering. 4 credits
Current water supply engineering practice, research, and new design methodologies.

ENE 616—Urban Environmental Problems. 4 credits
Overall problem of developing and maintaining a high quality physical environment in urban areas. Systems analysis approach to air, land, and water quality management problems.

ENE 617—Estuarine Systems. 4 credits
Changes in the environmental system of estuaries as they influence future pollution problems.

ENE 618—Pollution Transport Systems. 4 credits
Prerequisites: MS 305, EGC 601. Distribution of pollutants in natural waters and the atmosphere. Diffusive and advective transport phenomena.

ENE 626—Aquatic Microbiology. 4 credits
Role of microorganisms in fresh and marine waters which receive waste effluents or are used as public water supplies. Emphasis on phytoplankton.

ENE 627—Biology of Aquatic Systems. 4 credits
Macroscopic plant and animal forms which may serve as indicators of water quality in streams and lakes.

ENE 630—Environmental Chemistry. 5 credits
Prerequisite: CY 204 or CY 213. Water treatment, chemical composition of natural waters, and other phases of environmental chemistry. Applications of physical and organic chemistry to aqueous and gaseous systems.

ENE 631—Advanced Water Analysis. 4 credits
Advanced chemical procedures used in water chemistry research. Application of instrumental methods to determination of trace inorganic and organic natural water constituents.

ENE 636—Principles of Water Chemistry. 5 credits
Prerequisite: ENE 630. Application of chemical principles to the reactions and composition of natural waters. Emphasizes equilibrium and thermodynamic concepts.

ENE 640—Radiological Health. 3 credits
Prerequisite: PS 440. Nuclear radiation and resultant special problems in environmental engineering. Sources of radiation exposure. Assessment and control of environmental hazards.

ENE 641—Radiological Techniques. 5 credits
Prerequisite: ENE 640. Application of radiological techniques to environmental engineering. Theory and operation of advanced detection instrumentation. Laboratory experiments on measurement and control of radionuclides in the environment.

ENE 642—Radioactive Wastes. 4 credits
Prerequisites: ENE 500, ENE 640. Source, treatment, and disposal of radioactive wastes. Emphasis on prevention of environmental contamination.

ENE 643—Electronic Product Radiation. 4 credits
Prerequisite: Undergraduate course in modern physics. Evaluation of hazards, application of standards and engineering of controls for any electromagnetic or particulate radiation from an electronic device, especially microwave sources, lasers and all types of electronic components emitting X-rays.

ENE 650—Occupational Health. 4 credits
Prerequisite: ENE 668. Effects, assessment, and control of physical and chemical factors in man's working environment, including chemical agents, electromagnetic radiation, temperature, humidity, pressure, illumination, noise, and vibration.

ENE 651—Atmospheric Pollution. 3 credits
The atmosphere as a place of disposal for industrial and community effluents. Effects of air pollution, classification of wastes, evaluation of data.

ENE 652—Environmental Instrumentation. 5 credits
Basic instrumental components and assemblies thereof for the measurement and recording of environmental variables. Introduction to data telemetry systems and automatic data processing.

ENE 654—Air Pollution Sampling and Analysis. 4 credits
Determination of the concentration of normally encountered ambient pollutants. Methodology of source sampling. Practical experience in ambient and source sampling.

ENE 655—Air Pollution Control Measures. 4 credits
Equipment and methods for control of pollution caused by airborne materials.

ENE 656—Environmental Meteorology. 4 credits
Dynamics and thermodynamics of the atmosphere related to environmental problems. Analysis of weather charts. Numerical weather prediction models.

ENE 657—Environmental Micrometeorology. 4 credits
Statistical theory of turbulence and phenomena related to problems in diffusion and dispersion of contaminants in the lowest layer of the atmosphere. Time series analysis of meteorological variables.

ENE 660—Ecological and General Systems. 4 credits
Prerequisite: MS 305 or consent of instructor. Systems ecology including examples, languages, theoretical formulations, and models for the design, synthesis, and prediction of systems of man and nature.

ENE 668—Man and His Environment. 5 credits
Human physiology, toxicology, and epidemiology as they influence the work of the engineer in environmental health. Areas which affect man by contact with air, water, and food.

ENE 670—Graduate Environmental Engineering Seminar. 0 to 2 credits

ENE 671—Special Problems in Environmental Engineering 1. 1 to 5 credits
May be repeated with change of content up to a maximum of 12 credits.

ENE 680—Solid Wastes. 3 credits
Quantities and characteristics of municipal refuse. Collection methods, equipment, and costs. Refuse disposal practices. Regional planning and management.

ENE 681—Analysis of Solid Wastes. 5 credits
Prerequisites: ENE 531, ENE 680. Physical and chemical analysis of refuse, calorific value, organic content, biodegradability, oxygen and nitrogen requirements. Identification of biological flora and fauna associated with composting.

ENE 682—Design of Solid Waste Management Systems. 5 credits
Prerequisite: ENE 680. Design of refuse collection systems, transfer stations, sanitary landfills, incinerators, and composting facilities. Analysis of construction and operation costs. On-site investigations and studies.

ENE 699—Master's Research. 1 to 17 credits

ENE 799—Doctoral Research. 1 to 17 credits

FINANCE AND INSURANCE

GRADUATE FACULTY 1970-71

MATTHEWS, C. A., *Chairman*; HOWARD, W. M.; MCFERRIN, J. B.; NELSON, R. E.; PETTWAY, R. H.; RATCHFORD, B. U.; RICHARDSON, J. G.; TYSSELAND, M. S.

Graduate Coordinator: C. A. MATTHEWS

Though no graduate major may be completed without adequate course work on the 600 or higher level, certain undergraduate courses in finance and insurance are available for graduate credit as a part of a candidate's major. These are: FI 420—Management of Bank Funds; FI 462—Group Insurance and Pension Plans; and the 500-level courses listed below.

For admission to courses 600 level and above, the student must have been admitted to the Graduate School and normally should have undergraduate courses in fields pertinent to the graduate courses selected; or, where necessary, special arrangements may be made with the approval of the department chairman.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

FI 524—INVESTMENT ANALYSIS. 4 credits
FI 528—CORPORATION FINANCE. 4 credits
FI 584—LEGAL ASPECTS OF INSURANCE. 3 credits
FI 586—ESTATES, TRUSTS, AND INSURANCE. 4 credits

GRADUATE COURSES

FI 620—PROBLEMS IN COMMERCIAL BANKING. 5 credits
Prerequisite: FI 420. Monopoly and competition as applied to banking; bank organization and structure, adequacy of bank capital, problems of asset management and of providing successor management.

FI 622—SEMINAR IN INVESTMENTS. 5 credits
Prerequisite: FI 524. Individual research and group discussion employing materials available from publications and reports by governmental agencies and groups in the industry.

FI 625—MONEY AND CAPITAL MARKETS. 5 credits
Prerequisites: ES 521, college-level mathematics, and statistics. Financial markets, with emphasis on flow of funds, interest rate determination, and allocation of resources.

FI 627—PROBLEMS IN CORPORATION FINANCE. 5 credits
Prerequisites: FI 326 or FI 590; FI 528. The firm's cost of capital and of the utilization by the firm of its cost of capital in its investing and financing decisions.

FI 628—CENTRAL BANKING POLICIES AND PROBLEMS. 5 credits
Prerequisite: FI 321 or ES 321. The functions, powers, and policies of central banks, the changing role of central banks in the economy.

FI 629—INTERNATIONAL FINANCE: MONETARY SYSTEMS. 5 credits
Prerequisite: FI 321 or ES 321. International monetary systems, post-World War II international monetary problems, and attempts at reconstruction.

FI 630—Individual Work in Finance. 2 to 5 credits
Prerequisites: Permission of the department and of the Director of Graduate Studies. Reading and/or research in finance as needed by graduate students. May be repeated with change of content up to a maximum of 8 credits.

FI 662—Seminar in Life Insurance. 5 credits
Prerequisite: FI 462. Problems in life insurance and related fields.

FI 665—Seminar in Property and Liability Insurance. 5 credits
Prerequisites: FI 365, FI 366. The meaning, economic influences, social values, principles and practices of property and liability insurance.

FI 668—Problems in Risk Management. 3 credits
The insurance hazards of business concerns and governmental units, with consideration of insurance protection available.

FI 699—Master's Research. 1 to 17 credits

FOOD SCIENCE

GRADUATE FACULTY 1970-71

Dennison, R. A., *Chairman*; Ahmed, E. M.; Appledorf, H.; Bates, R. P.; Dougherty, R. H.; Kesterson, J. W.; Knapp, F. W.; Koburger, J. A.; Moye, H. A.; Robbins, R. C.; Thompson, N. P.; Van Middelem, C. H.; Wheeler, W. B.; Wolford, R. W.

Graduate Coordinator: R. A. Dennison

The Department of Food Science offers work leading to the degrees of Master of Science in Agriculture and the Master of Agriculture. Programs leading to the degree Doctor of Philosophy with emphasis on problems related to food science may be obtained through the departments of Fruit Crops and Microbiology with faculty members from Food Science directing the program. Areas of specialization are nutrition, food product and process development, food chemistry, food microbiology, food quality, and food safety. In addition to studies with the conventional agricultural commodities the department has research projects with seafood.

Prerequisite for admission to graduate study, in addition to the requirements of the Graduate School, is a good scientific background. Students with insufficient background in chemistry, physics, mathematics, or microbiology will be required to take these prerequisite subjects without graduate credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

FS 501—Instrumental Analysis and Separations. 4 credits

FS 502—Nutritional and Toxicological Aspects of Foods. 4 credits

GRADUATE COURSES

FS 600—Research Planning. 2 credits
Food science investigations, identifying problems, planning and initiating research, experimental techniques, analysis of data, and reporting of results. Required of all first-year graduate students.

FS 605—Industrial Food Fermentations. 4 credits
Prerequisite: MCY 302. Microbiological, chemical, and physical principles in controlled fermentations of foods and food constituents.

FS 606—Food Processing Systems. 4 credits
Prerequisites: MS 302, MCY 302. Processing systems of current importance and those of future potential evaluated with emphasis on food engineering principles and the resulting biochemical, microbiological, and nutritional interactions.

FS 607—Food Chemistry. 4 credits
Prerequisites: BCH 512, FS 402. Functions of lipids, carbohydrates, proteins, enzymes, and other components in foods and their reactions and interactions during food processing and storage.

FS 608—Psychophysical Aspects of Foods. 4 credits
Physical and chemical stimuli controlling human sensory perception of texture, color, and flavor of foods. Methods of measurement and influence of processing methods on quality attributes of foods.

FS 621—Food Product Development. 4 credits
Prerequisite: 8 credits in food science. Theoretical and technological considerations of food product development.

FS 641—Advanced Human Nutrition. 3 credits
Prerequisite: BCH 512 or AL 527.

FS 642—Proteins and Amino Acids in Nutrition. 3 credits
Prerequisite: BCH 512. Nutritional aspects of proteins and amino acids with emphasis on requirements, evaluation, and formulation of diets for various physiological functions.

FS 643—Nutritional Aspects of Carbohydrates and Lipids. 3 credits
Prerequisite: BCH 512. Role of carbohydrates and lipids in nutrition, with emphasis on energy metabolism.

FS 651—Topics in Food Science. 1 to 6 credits
Special aspects of food science studied in the classroom, laboratory, library, pilot plant, or the food industry. May be repeated with change of content up to a maximum of 12 credits.

FS 661—Food Science Seminar. 1 credit
Preparation and presentation of reports on specialized aspects of research in food science.

FS 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

FS 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

FS 699—Master's Research. 1 to 17 credits

FORESTRY

GRADUATE FACULTY 1970-71

Gray, J. L., *Director;* Beckwith, S. L.; Cornwell, G. W.; Frazer, P. W.; Goddard, R. E.; Harper, V. L.; Huffman, J. B.; Kaufman, C. M.; Miller, J. W., Jr.; Schmidt, R. A.; Smith, W. H.; Stanley, R. G.; Sullivan, E. T.; Swinford, K. R.; White, L. D.

Graduate Coordinator: R. E. GODDARD

The School offers work leading to the degree of Master of Science in Forestry in the following fields: forestry, wildlife management, and forest products technology.

The Doctor of Philosophy degree may be earned in forest genetics, forest tree physiology, forest soils, forest entomology, forest pathology, and wildlife ecology through the Departments of Agronomy, Botany, Soils, Entomology and Nematology, Plant Pathology, and Zoology, respectively.

Prerequisites: Adequate preparation in biology, English, chemistry, and mathematics, which may be obtained by completing at least one year's work in each field.

Students with a background other than forestry may be required to take undergraduate forestry courses pertinent to their field of interest early in their graduate program. Such courses will be considered as foundation work and will not carry graduate credit.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

FY 500—INTRODUCTION TO FORESTRY RESEARCH. 3 to 6 credits
Maximum 6 credits

FY 509—WOOD STRUCTURE AND PROPERTIES. 5 credits

FY 528—ADVANCED FOREST MENSURATION. 5 credits

FY 536—WATERFOWL ECOLOGY. 5 credits

FY 550—METHODS IN NATURAL RESOURCE INTERPRETATION. 4 credits

FY 560—RANGE ECOSYSTEM MANAGEMENT. 5 credits

FY 561—RANGE ECOSYSTEM PLANNING. 4 credits

GRADUATE COURSES

FY 600—RESEARCH PROBLEMS IN FORESTRY. 3 to 9 credits
Problems in one or more of the following fields of forestry: economics, management, pathology, policy, recreation, silviculture, tree physiology. May be repeated with change of content up to a maximum of 12 credits.

FY 603—RESEARCH PROBLEMS IN WOOD UTILIZATION. 3 to 9 credits
May be repeated with change of content up to a maximum of 9 credits.

FY 605—RESEARCH METHODS IN WILDLIFE ECOLOGY. 4 credits
Field and laboratory procedures used in wildlife research.

FY 606—RESEARCH PROBLEMS IN WILDLIFE ECOLOGY. 3 to 9 credits
May be repeated with change of content up to a maximum of 9 credits.

FY 611—SEMINAR. 1 credit
Subjects in natural resource areas such as wildlife and forest ecology; physiology, soils, recreation, economics; wood properties and uses. Current research and literature are stressed. May be repeated with change of content up to a maximum of 3 credits.

FY 612—TOPICS IN FORESTRY. 1 to 5 credits
Selected topics in the forest sciences and the multiple-use management of forest land for timber production, wildlife, and recreation. May be repeated with change of content up to a maximum of 9 credits.

FY 614—Natural Resources Colloquium. 0 to 1 credit
Interdisciplinary discussions of topics of current interest relating to renewable natural resources and environmental quality. May be repeated. (Students making scheduled presentations may register for 1 credit; others register for zero credit.)

FY 615—Forest and Range Wildlife Ecology 1. 4 credits
Major ecosystems in the U.S. for forest and range animals. Plant and animal components and their relation to reproductive patterns and factors controlling wild animal populations.

FY 616—Forest and Range Wildlife Ecology 2. 4 credits
Continuation of FY 615.

FY 618—Tropical Forestry. 4 credits
Prerequisite: FY 403. Forests of the tropics, climatic influences, local laws and customs affecting forestry practice, multiple-use implications, wood properties and uses in relation to forest development, forest types and management; stress on American tropics.

FY 619—Tropical Forest Science. 12 credits
Prerequisite: Approval by Director of School of Forestry and by Organization for Tropical Studies. Limit: 12 participants. Eight weeks in the principal forest types of Central America. Offered spring quarter as part of the program of O.T.S.

FY 620—Advanced Physiology of Forest Trees. 3 credits
Prerequisite: BTY 515. Factors influencing forest tree and stand energy balance, flowering, seed production, germination, water relations and growth; applications to forestry problems.

FY 621—Biochemistry of Trees. 3 credits
Identical with BTY 611. Prerequisite: BCH 512. Metabolic processes and constituents associated with tree growth, reproduction, formation of wood, terpene and other natural products. Formation of important forest tree chemicals.

FY 626—Forest Genetics 1. 4 credits
Prerequisite: An acceptable background in genetics. Application of principles of genetics in the silvicultural handling of forest stands; selection, hybridization, and tree-breeding techniques.

FY 627—Forest Genetics 2. 4 credits
Continuation of FY 626.

FY 630—Forest Soils. 4 credits
Identical with SLS 630. Prerequisites: SLS 421, SLS 423; FY 403 or consent of instructor. Soils as a component of forest ecosystems. Soil chemical, physical, and biological properties influencing tree growth and biogeochemical cycles.

FY 631—Advanced Wood Preservation. 4 credits
Relationships between wood and wood-deteriorating agencies; evaluation and analysis of preservatives; factors involved in treating wood; treatment and service evaluation.

FY 652—Timber Physics. 3 credits
Prerequisite: PS 215. Physical nature and properties of wood in relation to moisture, heat, sound, electricity, and mechanical forces.

FY 653—Wood Chemistry. 3 credits
Prerequisite: Organic chemistry. Chemical nature and properties of wood and its constituents in relation to industrial processing.

FY 680—Advanced Forest Economics. 4 credits
Prerequisite: FY 420. Economics and economic problems of forestry and forest industries. Major emphasis on the forest economy of the United States.

FY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
FY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
FY 699—Master's Research. 1 to 17 credits

FOUNDATIONS OF EDUCATION

GRADUATE FACULTY 1970-71

Lewis, H. G., Sr., *Chairman*; Avila, D. L.; Baker, M. C.; Bridges, C. M., Jr.; Brown, B. B.; Busby, W. A.; Cage, B. N.; Combs, A. W.; Curran, R. L.; Dahms, A. M.; Garber, M.; Gordon, I. J.; Greenwood, G. E.; Guertin, W.; Hines, V. A.; Jester, R. E.; Newell, J. M.; Newman, A. J.; Purkey, W. W., Sr.; Renner, R. R.; Sherman, R. R.; Siegel, B. L.; Soar, R. S.; Ware, W. E.; Wass, H. L.

Graduate Coordinator: H. G. Lewis, Sr.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

EDF 540—Seminar in Measurement of Classroom Behavior. 5 credits

GRADUATE COURSES

EDF 600—History of Education. 5 credits
Salient issues in education from the Reformation to the present.
EDF 601—Ancient and Medieval Education. 5 credits
Pedagogical practice and thought in China, India, Semitic nations, Greece, Rome, Islam, and medieval and renaissance Europe.
EDF 610—Philosophical Foundations of Education. 5 credits
Philosophical bases for democracy and education.
EDF 620—Socio-Economic Foundations of Education. 5 credits
A survey of the socio-economic bases for education.
EDF 625—Educational Sociology. 5 credits
Prerequisite: EDF 620. Educational experiments with the social variables of decision-making systems, task, or curriculum, group size, and group social composition.
EDF 630—Individual Work. 2 to 5 credits
For advanced students who wish to study individual problems in psychological, social or philosophical foundations of education, or research or measurement under faculty guidance. May be repeated with change of content up to a maximum of 15 credits.
EDF 631—Comparative Education. 5 credits
Relationships of school and society in different cultural areas of the world.
EDF 632—Education in Latin America. 5 credits
Prerequisites: EDF 431, EDF 631, specialization in social science, or a reading knowledge of an appropriate foreign language. Traditions and contemporary problems.

EDF 640—Educational Psychology: Human Development. 5 credits
Current research and theories in the area of human development.

EDF 641—Educational Psychology: Personality Dynamics. 5 credits
Dynamics of behavior and their implications for education, counseling and guidance, administration, family relationships, and social action.

EDF 642—Educational Psychology: Problems. 5 credits
Individualized study of problems dealing with child development, adolescence, learning, and other areas of educational psychology.

EDF 643—Educational Psychology: Learning Theory. 5 credits
Logic and methodologies of theories of learning.

EDF 644—Laboratory in Human Development 1. 5 credits
Open to teachers working with students at the time of enrollment in the course or in special workshops.

EDF 645—Laboratory in Human Development 2. 5 credits
Prerequisite: EDF 644. Continuation of EDF 644.

EDF 646—Educational Psychology: General. 5 credits
Basic principles, techniques, and research in educational psychology; designed for graduate students preparing to teach who have a minimal background in psychology. Not open to students majoring in psychology or psychological foundations of education.

EDF 650—Measurement and Evaluation. 5 credits
Prerequisite: EDF 660. Procedures for measurement and evaluation in education.

EDF 660—Educational Statistics. 4 credits
Prerequisite: EDF 360. Statistical methods as applied to educational data and problems.

EDF 661—Computers in Educational Research. 5 credits
Prerequisites: EDF 360, EDF 450. Corequisite: EDF 660. Introduction to computer principles and programming, including practice problems on Computer Center equipment. Application to complex statistical analyses and educational research.

EDF 662—Practicum in Educational Research. 3 to 12 credits
Prerequisite: EDF 664. Arrangements must be made with instructor prior to registration. Experience in conducting various phases of quantitative educational research under individual supervision. May be repeated with change of content up to a maximum of 12 credits.

EDF 663—Research Methods in Education. 5 credits
Prerequisite: EDF 360 or EDF 450. Research methods applicable to classroom practices. Can not be used to meet the research preparation requirement for the Ed.D. degree.

EDF 664—Quantitative Foundations of Educational Research. 10 credits
Prerequisite: EDF 360. Integrated coverage through team teaching of fundamentals. Includes statistics, design, data processing, and familiarization with the general field of educational research. Not for credit if student has credits in EDF 660, EDF 661 or EDF 663.

EDF 690—Special Topics. 2 to 5 credits
Prerequisite: Permission of department chairman. May be repeated with change of content up to a maximum of 15 credits.

EDF 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EDF 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EDF 701—Educational Classics. 5 credits
Historical and philosophical examination of the enduring writings on education from ancient to modern times. May be repeated with change of content up to a maximum of 10 credits.

EDF 710—Education and Moral and Spiritual Ideas. 5 credits
Moral ideas, the relation of moral values to school subjects, and the question of direction and systematic moral and spiritual instruction in the schools.

EDF 711—Theories of Mind. 5 credits
Mind and thinking processes, with implications for curriculum organization and classroom practice.

EDF 712—Contemporary Educational Theories. 5 credits
A seminar for post-master's students. Contemporary philosophical theories of education.

EDF 720—School and Society. 5 credits
Open only to candidates for the Ed.S. or Ed.D. degrees. Provides a social and philosophic frame of reference for the society in which education occurs and its implications for the functioning of the school.

EDF 740—Educational Psychology: Cognition in the Educative Process. 5 credits
Prerequisite: EDF 640. Cognitive development as applied to curriculum development and teaching procedures.

EDF 741—Educational Implications of Perceptual Psychology. 5 credits
Prerequisite: EDF 641. Research literature on human behavior and its implications for educational theory and practice.

EDF 743—Advanced Educational Psychology: Learning. 5 credits
Prerequisite: EDF 643. Educational implications of contemporary approaches to learning. Relationship between topics in learning and their implications for instructional practices.

EDF 760—Methods of Educational Research. 4 credits
Prerequisite: EDF 360. Primarily for Ed.D. candidates. Examination of research methodologies. Problem identification as well as organization and presentation of data.

EDF 764—Advanced Quantitative Foundations of Educational Research. 5 credits
Prerequisite: EDF 664. Integrated coverage, through team-teaching, of important approaches to educational research. Includes advanced statistics, design, computer applications, and analysis of selected researches. May be repeaated with change of content up to a maximum of 10 credits.

EDF 765—Seminar in Educational Research. 4 credits
Prerequisite: EDF 664. Corequisite: EDF 764. Educational researches to develop appreciation of the investigations and understanding of the methodological techniques employed.

EDF 766—Analysis of Educational Research. 4 credits
Prerequisites: EDF 664, EDF 764. Corequisite: EDF 765. Educational researches to develop appreciation of important methodological techniques and newer approaches in educational research.

EDF 768—Evaluation of Educational Projects and Systems. 5 credits
Prerequisites: EDF 660 and EDF 661. Ways of evaluating special educational projects and continuously operating school systems.

EDF 780—Seminar in Educational Foundations. 5 credits
Historical, philosophical, social, psychological, aesthetic, and comparative foundations of education. May be repeated with change of content up to a maximum of 15 credits.

FRUIT CROPS

GRADUATE FACULTY 1970-71

Krezdorn, A. H., *Chairman;* Attaway, J. A.; Biggs, R. H.; Buchanan, D. W.; Campbell, C. W.; Ford, H. W.; Gerber, J. F.; Grierson, W.; Koo, R. C. J.; Lawrence, F. P.; Leonard, C. D.; Reitz, H. J.; Sharpe, R. H.; Sherman, W. B.; Sites, J. W.; Soule, J.; Stewardt, I.; Wiltbank, W. J.; Ziegler, L. W.

Graduate Coordinator: A. H. Krezdorn

The Department of Fruit Crops offers work leading to the degrees of Master of Agriculture, Master of Science in Agriculture, and Doctor of Philosophy.

The interest of the student and the guidance and facilities available will determine the field for the thesis problem when required. Through cooperation of the Florida Agricultural Experiment Station and its branch stations, it is possible for thesis research for the Master of Science in Agriculture and Doctor of Philosophy degrees in certain fields to be conducted at these stations.

Prerequisites for admission to graduate study include a sound background in horticulture, botany, mathematics, chemistry, entomology, soils, and plant pathology. The student will be held responsible for such basic undergraduate courses as are deemed necessary for the pursuit of his thesis work.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

FC 523—Major Tropical Fruits. 4 credits
FC 524—Minor Tropical and Subtropical Fruits. 4 credits

GRADUATE COURSES

FC 601—Fruit Crops Seminar. 1 credit
Required of all graduate students each quarter it is offered. May be repeated with change of content up to a maximum of 2 credits.

FC 602—Physiology of Fruit Crops. 5 credits
Prerequisite: BTY 310. Physiology of the growth and development of fruit crops, with emphasis on fruit trees.

FC 603—Morphology of Fruit Crops. 3 credits
Prerequisite: BTY 532. Morphological features of both tropical and temperate

zone fruit crops, their modification by environment, and their relation to cultural practices and production problems.

FC 604—Taxonomy of Fruit Crops. 3 credits

Prerequisite: BTY 380. Nomenclature, classification and identification of tropical and temperate zone fruit crops, with emphasis on the scientific basis and utility of the various systems.

FC 605—Breeding of Fruit Crops. 4 credits

Prerequisite: AY 362. Principles of fruit crop breeding and varietal improvement, including patterns of evolution, mechanisms of heredity, and genetic parameters. Specific breeding problems in tropical and deciduous fruit crops.

FC 606—Rootstock-Scion Relationships. 4 credits

Rootstock-scion relationships in their influence on disease susceptibilities, soil and climatic adaptions, bud-union incompatibilities, and fruit production.

FC 610—Citriculture. 5 credits

Citrus growing, emphasizing the problems offered by varying sites, soils, climates, stocks, and varieties.

FC 611—Citrus Production Management. 5 credits

Methods of tabulating and evaluating the functions of citrus trees in relation to fruit production. Actual field recognition of the various factors and the means of properly organizing field management.

FC 615—Agricultural Meteorology. 5 credits

Prerequisite: Consent of instructor. Climate and meterology of the biosphere with reference to fruit crops. Heat budget of the plant-soil surface, turbulent transport, evapotranspiration, frost protection, and agricultural climatology.

FC 620—Research Methods in Fruit Crops. 4 credits

Research methods, including literature survey, collecting, analyzing, interpreting and presenting data; methods of measurement of plant responses; use of instruments useful in plant analysis.

FC 621—Environmental Measurements. 5 credits

Prerequisites: MS 301, PS 213. Methods and techniques employed in the characterization of the biosphere. Sensor selection, measuring and recording equipment for light, wind, temperature, humidity, and heat flow.

FC 640—Topics in Fruit Crops. 2 to 4 credits

Study of contemporary research in fruit crops. May be repeated with change of content up to a maximum of 8 credits.

FC 670—Non-Thesis Research Methods in Fruit Crops. 1 to 9 credits
Maximum 9 credits

FC 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

FC 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

FC 699—Master's Research. 1 to 17 credits

FC 799—Doctoral Research. 1 to 17 credits

GEOGRAPHY

GRADUATE FACULTY 1970-71

McCune, S., *Chairman*; Anderson, J. R.; Antonini, G. A.; Crist, R. E.;

Cross, C. I.; Dickinson, J. C., III; Dunkle, J. R.; Marcus, R. B.; Niddrie, D. L.; Popenoe, H. L.; Smith, D. L.

Graduate Coordinator: J. R. Anderson

Graduate students may take work leading to the following degrees: Master of Arts or Master of Science (with thesis); Master of Arts in Teaching or Master of Science in Teaching (without thesis); Doctor of Philosophy. A graduate student must have an undergraduate major in geography of not less than 36 credits, or 54 credits in the social sciences, 27 of which are in geography. Deficiencies in undergraduate work in geography can be corrected concurrently with registration in graduate-level courses.

Candidates for the Ph.D. degree are expected to take the courses in geographic techniques and methods (GPY 501, GPY 505, GPY 508, GPY 600, GPY 601, GPY 605) unless such courses have been taken previously.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

GPY 501—Air Photo Interpretation. 5 credits
GPY 505—Maps and Graphs. 5 credits
GPY 508—Quantitative Analysis in Geography. 5 credits
GPY 526—Urban Geography. 3 credits
GPY 527—Industrial Location. 5 credits
GPY 535—Land Tenure. 3 credits

GRADUATE COURSES

GPY 600—History of Geographic Thought 1. 3 credits
Development of geographic knowledge and thought as illustrated by the writings of representative geographers and other scientists in related fields, both past and contemporary.

GPY 601—History of Geographic Thought 2. 3 credits
Continuation of GPY 600.

GPY 605—Field Course in Geography. 5 credits
Methods of geographical field work. Observation, classification, interpretation, note-taking, traversing, and mapping of data. Areal analysis: land forms, climate, vegetation, soils, resources, settlement patterns, and land use.

GPY 606—Individual Field Work. 3 credits
Continuation of GPY 605. May be taken concurrently with GPY 605.

GPY 615—Cultural Plant Geography in the Tropics. 3 credits
Origin and dispersal of economic plants in the tropics. Their areal distribution under varying cultural and physical environments. Potential and limitations of technology in raising food production.

GPY 621—Problems in Economic Geography. 3 credits
Development and spatial arrangement of economic activities. Individual studies of selected subjects required.

GPY 623—Geography of World Agriculture. 5 credits
World distribution of crops and livestock in relation to natural and cultural conditions; discussion of problems of agriculture in terms of products, economic organization, and agricultural regions; significance in world affairs.

GPY 625—Geography of Underdeveloped Lands. 3 credits
Underdeveloped areas, stressing the possibilities they offer in a rapidly changing and increasingly crowded world.

GPY 630—Individual Work. 1 to 5 credits
Reading or research in areas of geography. May be repeated with change of content up to a maximum of 15 credits.

GPY 635—Land and Water Utilization. 5 credits
Theory and methods of resource-use analysis, resource appraisal, and planning. Classification and mapping of land and water uses.

GPY 660—Geography of Rural Settlement. 5 credits
Rural settlement systems and social organization in the framework of cultural and physical landscape patterns.

GPY 661—Problems in Cultural Geography. 5 credits
Cultural problems pertaining to American social geography and to the impact of Western culture on aboriginal settlements.

GPY 681—Seminar: United States and Canada. 3 credits
Geography of the United States and Canada, with emphasis on patterns of settlement and the distribution and development of economic activities.

GPY 685—Seminar: Middle America and the Caribbean. 5 credits
Cultural, economic, political, and resource characteristics and development of representative areas.

GPY 686—Seminar: South America. 5 credits
Cultural, economic, political, and resource characteristics and development of representative areas.

GPY 687—Seminar: Brazil. 5 credits
Prerequisites: GPY 484, GPY 485, GPY 486. Search for and analysis of problems arising from the interaction between the physical and cultural environments in Brazil's major geographic regions.

GPY 688—Resource Utilization and Conservation in Latin America. 3 credits
Regional appraisal of the human and natural resources. Analysis of the role of resource utilization and conservation in the development of Latin American countries.

GPY 689—Seminar: Land, Man, and Migration in Latin America. 3 credits
Physical and cultural factors operative in population movements in Latin America, particularly from cold highlands to hot lowlands, and from rural sectors to metropolitan areas.

GPY 690—Tropical Lands and Their Utilization. 12 credits
Prerequisites: GPY 501, GPY 605. Field course emphasizing analytic inquiries into land use systems in Costa Rica. Special topics on land utilization types are: environmental influences, settlement and field patterns, the market factor, labor supply, and transportation. Given in Costa Rica as part of the program of the Organization for Tropical Studies.

GPY 695—Selected Topics in Geography. 1 to 6 credits
Prerequisite: Master's degree in geography or equivalent. Seminar in modern geography.

GPY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

GPY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

GPY 699—Master's Research. 1 to 17 credits
GPY 799—Doctoral Research. 1 to 17 credits

GEOLOGY

GRADUATE FACULTY 1970-71

Wahl, F. M., *Chairman*; Blanchard, F. N.; Brooks, H. K.; Eades, J. L.; Edwards, R. A.; Griffin, G. M.; Mifflin, M. D.; Nicol, D.; Patton, T. H.; Pierce, R. W., Jr.; Pirkle, E. C., Jr.; Randazzo, A. F.; Rappenecker, C.; Webb, S. D.

Graduate Coordinator: A. F. Randazzo

For admission to graduate status in the Department of Geology a student must have a baccalaureate degree with a major in geology or a related field. A course in field methods or a summer field course is recommended. Deficiencies in undergraduate work in geology can be corrected concurrently with registration in graduate level courses.

The Master of Science degree requires a thesis. The degree Master of Science in Teaching is offered with specialization in geology. Candidates for these degrees are advised to plan their work to secure a firm foundation in geology, mathematics, and chemistry, physics, or biology rather than to specialize too narrowly.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

GY 501—Geomorphology. 4 credits
GY 507—Vertebrate Paleontology. 4 credits
GY 508—Geochemistry 1. 4 credits
GY 511—Economic Geology 1. 4 credits
GY 512—Economic Geology 2. 4 credits
GY 515—Mineralogical Analysis by X-Ray Methods. 4 credits
GY 517—Marine Geology. 4 credits
GY 518—Optical Crystallography. 4 credits
GY 550—Ground Water Geology. 4 credits
GY 560—Sedimentology. 4 credits
GY 561—Sedimentary Petrology. 4 credits
GY 580—Development of the Geological Sciences. 3 credits

GRADUATE COURSES

GY 600—Tectonics. 4 credits
Prerequisite: GY 409. Characteristics, interrelationships, and development of large-scale structural units of the earth's crust.

GY 601—Geomorphology of Southeastern United States. 4 credits
Prerequisite: GY 501. Geomorphology of the Atlantic and Gulf Coastal Plain, including the Mississippi Flood Plain and Delta, the Piedmont, Crystalline, and Folded Appalachians, and southern part of the Appalachian Plateau and adjacent areas.

GY 607—Ancient Vertebrate Faunas. 4 credits
Identical with ZY 607. Prerequisite: ZY 507 or GY 507. Evolution, distribution, and extinction of vertebrate faunas with emphasis on problems in paleoecology, paleogeography, and patterns of phylogeny.

GY 608—Seminar in Evolution. 4 credits
Identical with ZY 608. Processes, mechanisms, patterns, and orientation of evolution.

GY 611—Mineralogy of Clays. 4 credits
Prerequisite: GY 518 or consent of instructor. Structure, composition, properties, origin, and mode of occurrence of the clay minerals.

GY 618—Petrographic Mineralogy. 4 credits
Prerequisite: GY 518. Igneous petrography by use of thin sections.

GY 619—Sedimentary Petrography. 4 credits
Prerequisite: GY 518. Sedimentary rocks in thin section, with emphasis on their genesis as determined from mineral composition, texture, and occurrence.

GY 623—Micropaleontology. 4 credits
Foraminifera, Ostracoda, and other microscopic fossils.

GY 624—Paleoecology. 4 credits
Prerequisite: GY 421 or ZY 308. Paleoautecology, paleosynecology, historical biogeography of marine invertebrates, and ecological rules as applied to fossil invertebrates.

GY 625—Advanced Invertebrate Paleontology. 4 credits
Prerequisite: GY 421. Local field problems in paleoecology or biostratigraphy.

GY 630—Individual Work. 1 to 5 credits
For work beyond that offered in regular courses. May be repeated with change of content up to a maximum of 15 credits.

GY 640—Cenozoic and Mesozoic Stratigraphy. 4 credits
Cenozoic and Mesozoic stratigraphy with emphasis on the stratigraphy of the Gulf and Atlantic Coastal Plain; American and European relationships.

GY 651—Hydrogeology. 4 credits
Prerequisite: GY 550 or consent of instructor. Principles and concepts of groundwater flow systems; techniques of flow system delineation; hydrogeologic problems common to water development.

GY 660—Seminar. 1 credit
Readings in special topics of geology with application to the Coastal Plain. May be repeated with change of content up to a maximum of 3 credits.

GY 664—Fluvial, Deltaic, and Transitional Environments of Sedimentation. 4 credits
Prerequisites: GY 470; GY 560, GY 561, or consent of instructor. Environmental factors and sediment types accumulated in fluvial, deltaic, and other transitional environments; recognition of these environments in ancient rocks.

GY 668—Coastal and Estuarine Geology. 4 credits
Prerequisites: GY 517; GY 560 or COE 610. Origin and distribution of coastal and estuarine earth materials, evolution of morphological features and the dynamic changes that occur because of the interplay between terrestrial, marine, and atmospheric processes.

GY 675—Geological Oceanography I. 4 credits
Prerequisites: GY 470, and GY 517, or consent of instructor. Structural development, sedimentation processes, and sediments of continental slope, rise, abyssal plain, and associated deep-sea environments.

GY 690—Special Topics in Geology. 4 credits
Lectures, conferences, or laboratory sessions covering selected topics of current interest in modern geology. May be repeated with change of content up to a maximum of 12 credits.
GY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
GY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
GY 699—Master's Research. 1 to 17 credits

GERMANIC AND SLAVIC LANGUAGES AND LITERATURES

GRADUATE FACULTY 1970-71

Krispyn, E., *Chairman;* Craps, J. E.; Johnston, O. W.; Mauderli, M. O.; Sullivan, W. J.; Tunstall, G. C.; Valk, M. E.

Graduate Coordinator: E. Krispyn

The department offers programs of study leading to M.A. and M.A.T. degrees in German. In addition, sufficient courses are available for a graduate minor in Russian.

The *prerequisite* for admission to graduate work is an undergraduate major in the field, including advanced courses in both literature and language. A good foundation in a second language is desirable.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

GN 506—Advanced Grammar and Composition. 4 credits
GN 512—History of the German Language. 4 credits
GN 513—German Lyric Poetry. 4 credits
GN 528—Aufklärung and Sturm und Drang. 4 credits
GN 529—The Classical Period. 4 credits
GN 530—The Romantic Period and "Junges Deutschland." 4 credits
GN 540—German Drama. 4 credits
GN 545—Realism and Naturalism. 4 credits
GN 550—Philosophical Background of German Literature. 4 credits
GN 555—Middle High German. 3 credits
GN 560—20th-Century German Literature. 4 credits

RSN 506—Advanced Grammar and Composition. 4 credits
RSN 512—History of the Russian Language. 4 credits
RSN 513—Structure of the Russian Language. 4 credits
RSN 514—Old Church Slavic. 4 credits

GRADUATE COURSES

GN 600—Special Study in German Literature. 4 credits
Intensive study of a selected topic. May be repeated with change of content up to a maximum of 16 credits.

GN 602—Beginning German for Graduate Students 1. 4 credits
Prerequisite: Graduate status. For students with no formal preparation who need to acquire a reading knowledge. Credits do not count toward any graduate degree.

GN 603—Beginning German for Graduate Students 2. 4 credits
Prerequisites: Graduate status; GN 602 or the equivalent. For students working to acquire proficiency in reading. Credits do not count toward any graduate degree.

GN 604—Goethe. 4 credits

GN 605—Individual Work. 1 to 4 credits
Available only by special arrangement with a graduate adviser. May be repeated with change of content up to a maximum of 16 credits.

GN 620—Gothic. 4 credits

GN 624—Introduction to Old Icelandic. 3 credits

GN 625—Readings in Old Icelandic. 3 credits

GN 650—Seminar in Germanic Studies. 4 credits
Methodology and research problems. Required of all candidates for a master's degree in German.

GN 651—Middle High German Literature. 3 credits
Prerequisite: GN 555 or equivalent. Major works of Hartman von Aue, Gottfried von Strassburg, Wolfram von Eschenbach, and Walter von der Vogelweide.

GN 652—German Literature of the Baroque. 4 credits
Period of the Baroque with critical reference to the secondary literature.

GN 653—German Literature Since 1945. 4 credits
Developments and trends in German writing since World War II.

GN 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

GN 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

GN 699—Master's Research. 1 to 17 credits

HEALTH AND HOSPITAL ADMINISTRATION

GRADUATE FACULTY 1970-71

Champion, J. M., *Chairman*; Herhold, W. H.; Schwartz, M. R.; Strack, J. G.

Graduate Coordinator: J. M. Champion

The program in health and hospital administration offers the following courses as part of the major sequence leading to the degree Master of Business Administration with a concentration in Health and Hospital Administration; the degree is offered by the College of Business Administration. The requirements for this degree are described more fully in the section of the catalog dealing with requirements for the Master of Business Administration.

For admission to courses listed below, the student must have been admitted to the Graduate School, College of Business Administration, and to the program in health and hospital administration.

For listings of other courses required of students enrolled in the program in health and hospital administration, see *Business Administration* (BS 610, BS 664, BS 671, BS 679, BS 690, BS 691); Economics (ES 615, ES 616); Industrial and Systems Engineering (ISE 635).

GRADUATE COURSES

HA 600—Perspectives in Health. 4 credits
Factors operating in health and disease in an individual or a society. Historical and social background of disease, its etiology, and the organization of medical care.

HA 601—Hospital Organization, the Community and Patient Care. 3 credits
The hospital culture in relation to organizational philosophy and changing health patterns, with emphasis on the patient care process; concept and application of environmental therapy; current research in the hospital and health field.

HA 602—Financial Administration of Health and Hospital Care. 3 credits
Analysis of sources and uses of health care funds.

HA 610—Seminar in Health and Hospital Administration. 4 credits
Departmental organization of the general hospital, designed to help integrate course work with the administrative residency.

HA 611—Seminar in Health and Hospital Administration. 2 credits
Formal study, through readings, lectures, and case discussions, of major issues and problems in hospital organization and management.

HA 612—Introduction to Rehabilitation Facility Administration. 2 credits
Rehabilitation process as it relates to administration of rehabilitation facilities; history and philosophy of the rehabilitation movement; system of delivering rehabilitation services.

HA 630—Individual Work in Hospital Administration. 2 credits
Reading and/or research in hospital administration.

HA 640—Research in Health and Hospital Administration. 5 credits
Directed investigation of an administrative problem fundamental to health and hospital administration.

HA 641—Practicum in Health and Hospital Administration. 2 to 7 credits
Application of management concepts and principles to voluntary and governmental health facilities, associations, and organizations. May be repeated with change of content up to a maximum of 7 credits.

HA 646—Residency in Health and Hospital Administation. 7 credits
Prerequisite: Consent of department. Supervised field work in an administrative setting. Designed as a sequence of two quarters. May be repeated up to a maximum of 14 credits.

LW 686—Hospital and Health Law Seminar. 2 credits
Law relating to hospital and medical administration. Designed especially for students in the graduate program in hospital and health administration.

HEALTH RELATED PROFESSIONS—GENERAL

GRADUATE FACULTY 1970-71

MASE, D. J., *Dean;* BZOCH, K. R.; JANTZEN, A. C.; KRAMER, S.; SUZUKI, H. K.; WHITE, B. C.; WILLIAMS, R.

The following courses are offered under the supervision of the office of the dean by an interdisciplinary faculty and deal with material of concern to two or more of the areas of specialty offered in the College of Health Related Professions. These courses are also open to students of other colleges, with the permission of the course instructor.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

HRP 550—SEMINAR: BIOLOGICAL BASIS OF CHARACTER STRUCTURE AND SOCIAL BEHAVIOR. 4 credits

HRP 551—LABORATORY STUDY OF EMERGENT LANGUAGE BEHAVIOR. 6 credits

GRADUATE COURSES

HRP 600—PERSPECTIVES IN HEALTH. 4 credits

Identical with HA 600. Health and disease in an individual or a society. Historical and social background of disease, its etiology, and the organization of medical care.

HRP 620—SEMINAR: THE HEALTH RELATED PROFESSIONS. 4 credits

Trends affecting the health professions and the relations among these professions, the scientific disciplines, and the community. Required for Allied Health Professions Trainees.

HRP 630—INDIVIDUAL STUDY IN HEALTH RELATED PROFESSIONS. 3 to 5 credits

Tutorial program to investigate problems significant to the health related professions. May be repeated with change of content up to a maximum of 10 credits.

HRP 697—SUPERVISED RESEARCH. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

HRP 698—SUPERVISED TEACHING. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

HISTORY

GRADUATE FACULTY 1970-71

MAHON, J. K., *Chairman*; BARINGER, W. E.; BUSHNELL, D.; CHALMERS, D. M.; CHANG, R. T.; DOHERTY, H. J.; DOTY, F. A.; ENTNER, M. L.; FUNK, A. L.; GANNON, M. V.; HAMMOND, E. A.; HANNA, P. L.; HENRY, G. S.; KELE, M. H.; MACAULAY, N. W.; MCALISTER, L. N.; PAUL, H. W.; PROCTOR, S.; STURGILL, C.; SUAREZ, A.; WILENSKY, N.; WILSON, H. A.; WINIUS, G. D.; WOODRUFF, W.

Graduate Coordinator: L. N. McAlister

Master of Arts in Teaching. Purpose: The degree is offered primarily to prepare students for teaching in secondary schools or junior colleges. *Requirements*: At least 54 quarter credits while registered as a graduate student with work distributed as follows: (1) at least 28 credits in history; (2) at least 8 credits in a minor outside of history; (3) 9 credits in a departmental Internship in Teaching; (4) at least one course each in educational psychology, sociology of education and school curriculum. The candidate must also demonstrate a reading knowledge of one foreign language.

Master of Arts. Purpose: To prepare students for teaching in junior or four-year colleges, for careers in business or government, or for further graduate work at the Ph.D. level. *Fields offered:* The degree may be taken with concentrations in the following fields of history: medieval, early modern European (16th to 18th centuries), modern European (18th to 20th centuries), British, United States, Latin American, Middle Eastern, East Asian, and African. *Requirements:* (1) At least 53 credits normally distributed as follows: 20 in the field of concentration, 16 in other fields of history including 4 each in HY 602 and HY 603—Theories and Methods, 8 in a minor outside of history, and 9 in HY 699—Master's Research; (2) a thesis in the field of concentration with credit given under HY 699 as noted above; (3) a reading knowledge of one foreign language.

Doctor of Philosopsy. Purpose: To prepare students for careers of teaching or for research in colleges and universities, business, or government. *Fields of concentration:* The degree is offered with concentration in United States, Modern European, or Latin American history. *Requirements:* (1) Passage of qualifying examinations consisting of written examinations in the field of concentration and four minor fields and a general oral. The minor fields may be selected from among the three fields of doctoral concentration named above and fields of concentration listed under the M.A. degree. With the permission of his supervisory committee, the student may substitute for one of the listed fields a specially constructed minor which relates directly to his primary teaching and research interests. (2) HY 602 and 603—Theory and Method and HY 700—Comparative History. (3) A reading knowledge of at least one foreign language. (4) A dissertation in the field of concentration for which credit is given under HY 799—Doctoral Research.

Admission: A description of requirements and procedures may be obtained from the Graduate Coordinator.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

HY 501—Ancient and Medieval Science.	3 credits
HY 502—The Scientific Revolution.	3 credits
HY 503—Science since Newton.	3 credits
HY 508—The Golden Age of Greece, 546–404 B.C.	4 credits
HY 509—The Roman Republic.	4 credits
HY 510—European Military History to 1783.	4 credits

HY 511—European Military History since 1783. 4 credits
HY 513—Economic and Social History of Modern Russia and the Soviet Union. 4 credits
HY 514—Twentieth Century European Diplomacy to World War II. 4 credits
HY 515—Diplomatic and Military History of World War II. 4 credits
HY 517—Early Modern Europe: Society and Politics. 4 credits
HY 519—European Thought. 4 credits
HY 520—European Thought. 4 credits
HY 521—European Expansion, 15th, 16th Centuries. 4 credits
HY 522—European Expansion, 17th, 18th Centuries. 4 credits
HY 525—The 18th-Century Revolutions, 1760-1815. 4 credits
HY 526—Modern France from the Restoration to the Fifth Republic. 4 credits
HY 531—Germany in the 19th Century. 4 credits
HY 532—Germany in the 20th Century. 4 credits
HY 534—Economic History of Europe to 1350 A.D. 4 credits
HY 535—Economic History of Europe, 1350-1700. 4 credits
HY 537—Southern Africa. 4 credits
HY 539—Modern Africa. 4 credits
HY 540—U.S., Cultural and Intellectual, to the Civil War. 4 credits
HY 541—U.S., Cultural and Intellectual, since the Civil War. 4 credits
HY 543—U.S. Military Policy in War and Peace 1. 3 credits
HY 544—U.S. Military Policy in War and Peace 2. 3 credits
HY 545—U.S., Populist Era to the Great Depression. 4 credits
HY 546—U.S., since the Great Depression. 4 credits
HY 547—Colloquium, History of the Afro-American. 4 credits
HY 548—Problems in Afro-American History. 4 credits
HY 554—Colonial America. 4 credits
HY 555—American Revolutionary Era. 4 credits
HY 560—The Iberian Peninsula to 1700. 4 credits
HY 561—The Iberian Peninsula since 1700. 4 credits
HY 570—Caribbean, the Old Colonial System. 4 credits
HY 571—Caribbean, 19th, 20th Centuries. 4 credits
HY 572—Mexico to 1848. 4 credits
HY 573—Mexico since 1848. 4 credits
HY 574—The Grand Colombian Nations. 4 credits
HY 576—The Platine Republics. 4 credits
HY 577—Chile, Peru, and Bolivia. 4 credits
HY 578—Brazil to 1822. 4 credits
HY 579—Brazil since 1822. 4 credits
HY 581—East Asian Thought. 4 credits
HY 582—Japan to 1800. 4 credits
HY 583—Japan since 1800. 4 credits
HY 591—Masterpieces in Social Sciences 1. 4 credits
HY 592—Masterpieces in Social Sciences 2. 4 credits

HY 593—Masterpieces in Social Sciences 3. 4 credits
HY 599—Special Studies. 4 credits. Maximum 16 credits

GRADUATE COURSES

HY 602—Theories and Methods 1. 4 credits
Required of all candidates for M.A., M.A.T., Ph.D. degrees.
HY 603—Theories and Methods 2. 4 credits
Continuation of HY 602. Required of all candidates for M.A., M.A.T., Ph.D. degrees.
HY 613—The Middle Ages. 4 credits
May be repeated with change of content up to a maximum of 12 credits.
HY 614—The United States in the World Economy, 1783–1960. 5 credits
Identical with ES 614. Interrelatedness of the United States economy with the economies of other lands; circumstances which have enabled the American people to alter the course of world history.
HY 618—Europe, 1500 to 1763. 4 credits
HY 619—European Expansion. 4 credits
HY 620—Seminar in the History of Modern European Thought. 4 credits
May be repeated with change of content up to a maximum of 12 credits.
HY 623—Readings, Modern Europe. 4 credits
There are three sequences: 1763 to 1815; 1815 to 1914; 1914 to date. May be repeated with change of content up to a maximum of 12 credits.
HY 624—Central Europe. 4 credits
HY 625—Western Europe Since the French Revolution. 4 credits
HY 626—Eastern Europe. 4 credits
HY 630—Individual Study. 4 credits
May be repeated with change of content up to a maximum of 16 credits.
HY 633—England. 4 credits
May be repeated with change of content up to a maximum of 12 credits.
HY 641—Seminar in the History of American Military Policy. 4 credits
May be repeated with change of content up to a maximum of 8 credits.
HY 642—Seminar in American Thought. 4 credits
May be repeated with change of content up to a maximum of 12 credits.
HY 646—Colonial America. 4 credits
English colonies from their origins to about 1781.
HY 647—United States, Early National. 4 credits
From 1781 to the end of the War of 1812.
HY 648—United States, the Middle Period. 4 credits
From 1815 to 1850.
HY 649—United States, Division and Reunion. 4 credits
From the War with Mexico to 1877.
HY 650—The Emergence of Modern America. 4 credits
From 1877 to the entrance of the U.S. into World War I.
HY 651—Recent America. 4 credits
From U.S. entrance into World War I to U.S. entrance into World War II.

HY 660—Africa. 4 credits
May be repeated with change of content up to a maximum of 12 credits.
HY 670—Historical Literature of Latin America 1. 4 credits
HY 671—Historical Literature of Latin America 2. 4 credits
Continuation of HY 670.
HY 672—Brazil. 4 credits
May be repeated with change of content up to a maximum of 12 credits.
HY 673—Spanish America. 4 credits
May be repeated with change of content up to a maximum of 12 credits.
HY 681—Readings in Chinese History. 4 credits
HY 682—Readings in Japanese History. 4 credits
HY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
HY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
HY 699—Master's Research. 0 to 17 credits. Maximum 30 credits
HY 700—Comparative History. 4 credits
May be repeated with change of content up to a maximum of 12 credits.
HY 799—Doctoral Research. 1 to 17 credits

IMMUNOLOGY AND MEDICAL MICROBIOLOGY

GRADUATE FACULTY 1970-71

Small, P. A., Jr., *Chairman;* Baer, H.; Billen, D.; Centifanto, Y.; Clem, L. W.; Crandall, R. B.; Cusumano, C.; Gifford, G. E.; Mans, R. J.; McGuigan, J. E.; Moscovici, C.; Rosen, I. G.; Sanders, W. E.; Shands, J. W., Jr.; Suter, E.; Waldman, R. H.

Graduate Coordinator: G. E. Gifford

The Department of Immunology and Medical Microbiology offers a program leading to the Master of Science and Doctor of Philosophy degrees in microbiology, including the field of parasitology. Through individual planning of course work, research, and teaching, the graduate student is offered an educational atmosphere to help him develop certain skills and gain intellectual independence and initiative. The program is in close collaboration with the Department of Microbiology in the College of Arts and Sciences.

The undergraduate preparation for graduate study in microbiology should be wide in scope and should include general biology, physics, chemistry (2 to 3 years, including organic and quantitative analysis), and preferably statistics, calculus, physical chemistry, genetics, and bacteriology. A bachelor's degree in bacteriology or microbiology is not required. In graduate school the student will at first obtain a general background in microbiology as preparation for research and teaching. The remaining course work should be arranged according to the student's interests and competence. Emphasis is placed on the following areas: bacterial physiology, virology, immunology, immunochemistry, microbial genetics, parasitology, and infectious diseases.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

MED 551—Microbiology. 7 credits
MED 554—Medical Parasitology. 2 credits

GRADUATE COURSES

MED 650—Public Health Microbiology. 1 to 6 credits
Identical with MCY 650. Prerequisites: Permission of department chairman and director of laboratories. Reference study, laboratory practice of diagnostic techniques in Microbiology Diagnostic Laboratories of Shands Teaching Hospital of University of Florida Health Center, or in residence at Bureau of Laboratories, State Department of Health, Jacksonville. May be repeated with change of content up to a maximum of 18 credits.

MED 651—Special Topics in Microbiology. 3 credits
Identical with MCY 651. Prerequisite: 6 credits in graduate major courses. Contemporary research in an aspect of general microbiology. May be repeated with change of content up to a maximum of 6 credits.

MED 652—Virology. 5 credits
Identical with MCY 652. Nature of viruses and mechanisms of viral infection: animal, bacterial, and plant viruses.

MED 653—Virology Laboratory. 3 credits
Identical with MCY 653. Prerequisite or corequisite: MED 652. Laboratory experiments on the nature of viruses and mechanisms of viral replication; other consequences of viral infections.

MED 654—Research Planning. 5 credits
Identical with MCY 654. Prerequisite: 20 credits in progressive study of microbiology. Scientific research, including initiating a problem, experimental techniques, analysis and evaluation of data, reporting; illustrated by bacteriological examples.

MED 655—Experimental Microbiology. 2 to 5 credits
Identical with MCY 655. Prerequisite: 12 credits of microbiology. Application of physical, chemical, and biological techniques to experimental problems in microbiology. Individual laboratory study under supervision. May be repeated with change of content up to a maximum of 8 credits.

MED 656—The Literature of Microbiology. 3 credits
Identical with MCY 656. Prerequisite: 12 credits of microbiology. Bibliographic method in searching the literature of specified areas of the discipline.

MED 657—Microbial Metabolism. 5 credits
Identical with MCY 657. Prerequisities. BCH 601, BCH 603. Intermediary metabolism of microorganisms; metabolic pathways that are unique or characteristic primarily of microorganisms.

MED 658—Microbial Physiology. 5 credits
Identical with MCY 658. Prerequisite: MED 657. Structural and functional elements of microorganisms and mechanics of their regulatory systems. Mechanisms of control of microbial DNA replication, cell division, ribosome and cell-wall formation; kinetic studies of normal and abnormal growth.

MED 659—Principles of Immunology. 5 credits
Identical with MCY 659. Prerequisite: MCY 505 or MED 551. Biological and

biochemical aspects of host resistance and immunity; the chemical and physicochemical properties of the proteins of immune reactions.

MED 660—Immunology Laboratory. 3 credits

Identical with MCY 660. Corequisite: MED 659. Consent of staff required.

MED 661—Biology of Uncommon Microorganisms. 5 credits

Identical with MCY 661. Prerequisite: MCY 302. Natural distribution, metabolic activities, isolation, and culture of selected groups of microorganisms.

MED 662—Microbial Genetics. 5 credits

Prerequisites: MCY 520, MCY 521, general genetics. Microbial genetics, including mutation, selection, transformation, transduction, conjugation and episomal factors; molecular structure and function of genes.

MED 663—Parasitic Diseases of the Tropics and Subtropics. 5 credits

Identical with MCY 663, VY 663, ZY 663. See MCY 663.

MED 664—Viral Diseases. 3 credits

Identical with MCY 664. Prerequisite: MED (MCY) 652. Pathogenesis of viral disease including cytopathic and oncogenic viruses. Diagnostic and preventive measures.

MED 665—Microbial Infections. 5 credits

Pathogenesis of selected bacterial and fungal diseases emphasizing the clinical and pathological aspects of human infection.

MED 666—Microbiology 1. 6 credits

Identical with MCY 666. Intensive review of principles of immunity, physiology, and genetics of bacteria, virology, infection, and ecology. (See also MED 667).

MED 667—Microbiology 2. 3 credits

Identical with MCY 667. Continuation of MED 666.

MED 668—Regulation in Biological Systems. 5 credits

Identical with MCY 668. Prerequisites: MCY 520, MCY 521, MCY 657; BCH 601, BCH 602. Control of enzyme activity: kinetic, structural, inhibition (allosteric and non-allosteric), and energy level control; permeases; control of enzyme synthesis: positive and negative; repression, induction, catabolic repression, cyclic AMP; hormonal control.

MED 669—Seminar. 1 credit

Identical with MCY 669. Attendance required of all graduate majors at one research presentation and one graduate report each week as scheduled. May be repeated with change of content.

INDUSTRIAL AND SYSTEMS ENGINEERING

GRADUATE FACULTY 1970-71

Braswell, R. N., *Chairman;* Ariet, M.; Burns, J. F.; Capehart, B. L.; Dominiak, K. E.; Heaney, J.; Hicks, P. E.; Hodgson, T.; Ireland, R.; Khalil, T.; Kilpatrick, K.; Leavenworth, R. S.; Mahoney, J. F.; Marban, J.; Martinson, E. P. (*emeritus*); Miller, D. R.; Muth, E. J.; Nattress, J. A.; Proctor, C. L.; Ratliff, H. D.; Roberts, S. D.; Sivazlian, B. D.; Thomas, M. E.; Turvaville, L. J.; Valisalo, P. E.; Vickers, F. D.; Wilcox, D. B.

Graduate Coordinator: D. R. MILLER

Prerequisite for admission to graduate work in Industrial and Systems Engineering is a degree in one of the engineering disciplines, mathematics, statistics, or physics. Where the student's background is deficient, an articulation program of foundation courses will be required.

In addition to offering master's degree programs, the Department of Industrial and Systems Engineering offers the degrees of Engineer and Ph.D. with a major in Systems Engineering (Operations Research). In order to guide himself toward a realistic self-assessment of his research interests and capabilities, each Ph.D. student will initially prepare himself in a common core area consisting of specified courses in statistics, mathematics, optimization principles and methods, systems analysis, stochastic processes, and digital computer technology.

Special courses are offered for advanced graduate students under the ISE 696 and ISE 797 numbers. Courses such as Advanced Topics in Integer Programming, Markovian Decision Processes, Non-Poisson Queues, Decomposition Techniques in Nonlinear Programming are typical of those available to the student.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ISE 550—COMPUTER PROGRAMMING SYSTEMS. 3 credits
ISE 551—DIGITAL COMPUTING TECHNIQUES 1. 3 credits
ISE 552—DIGITAL COMPUTING TECHNIQUES 2. 3 credits
ISE 557—ANALOG SIMULATION TECHNIQUES. 3 credits
ISE 558—HYBRID COMPUTER TECHNIQUES. 3 credits
ISE 562—RELIABILITY ENGINEERING. 3 credits

GRADUATE COURSES

ISE 601—CLASSICAL OPTIMIZATION THEORY. 3 credits

Prerequisites: Matrix theory, advanced calculus. Conditions for maxima and minima of differentiable functions; unconstrained, equality constrained, and inequality constrained functions.

ISE 602—DYNAMIC PROGRAMMING. 3 credits

Prerequisite: ISE 601. Characterization of multistage decision problems as a sequence of single-stage problems. Functional equation of dynamic programming, composition, and Mitten's sufficiency condition. Markovian decision problems, state variable reduction techniques, and related approximation schemes.

ISE 603—DYNAMIC OPTIMIZATION THEORY. 3 credits

Prerequisites: ISE 601, ISE 602. Dynamic programming approach to the necessary conditions of variational calculus. Pontryagin's Maximum Principle, continuous and discrete. Comparison of variational approach and dynamic programming from a computational point of view.

ISE 604—LINEAR PROGRAMMING. 3 credits

Prerequisite: Matrix theory. Theoretical and computational aspects of linear programming. Simplex method, degeneracy, revised simplex method, transportation problems, network flows, and sensitivity analysis.

ISE 605—Advanced Topics in Linear Programming. 3 credits

Prerequisite: ISE 604. Duality in linear programming. Multistage linear, integer, stochastic, and zero-one programming. Various solution algorithms will be derived and discussed.

ISE 606—Nonlinear Programming. 3 credits

Prerequisites: ISE 601, ISE 605. Optimization techniques for static and dynamic nonlinear systems subject to various constraints. Inequality theorems, geometric programming, convex programming, decomposition, and optimum seeking methods.

ISE 607—Flows in Networks. 3 credits

Prerequisite: ISE 604. Mathematical formulations and solution techniques for general flow problems. Applications to transportation, defense and communication networks.

ISE 608—Discrete Optimization Theory. 3 credits

Prerequisite: ISE 604. Mathematical modeling and optimization theory associated with problems with variables restricted to integer values. Algorithms for general classes of problems and for special applications.

ISE 610—Mathematical Theory of Inventory. 3 credits

Prerequisites: ISE 671, STA 660. Mathematical theory of inventory systems. Single- and multicommodity inventory problems analyzed as problems in dynamic programming and as Markov decision processes.

ISE 611—Industrial Dynamics 1. 3 credits

Prerequisites: Computer programming and probability theory. Dynamics of industrial systems, emphasizing models that incorporate decision making, its interactions with information, money, orders, material, personnel, and capital equipment, using theories of elementary feedback systems, difference equations, and probability.

ISE 612—Industrial Dynamics 2. 3 credits

Prerequisite: ISE 611. Continuation of ISE 611 to include dynamic simulation models, improvement of system behavior through changes in system structure and decision policy, and the interpretation of simulation results relative to system objective.

ISE 620—Games and Gaming. 3 credits

Prerequisites: Matrix theory, probability theory. Games in extensive and normal form. Two-person games. Formulation of two-person games as a linear programming problem. Cooperative and noncooperative games. Concepts and methods of gaming, including experimental management gaming.

ISE 621—Advanced Engineering Economy. 3 credits

Prerequisites: STA 440, ISE 571. Mathematical models for expenditure analysis under uncertainty. Relationship between investment decision criteria and microeconomic theory. Capital planning and budgeting. Decisions involving expansion, acquisitions, replacement, and disinvestment.

ISE 622—Decision Theory. 3 credits

Prerequisites: ISE 621, ISE 671. Formulation of decision criteria and decision strategies in a probabilistic environment. Industrial applications of input-output analysis and von-Neumann-Morgenstern utility theory. Statistical decision functions.

ISE 630—Advanced Production Control. 3 credits

Prerequisites: ISE 571, ISE 671. Production planning and control; problem identification and formulation.

ISE 631—Work Measurement Theory. 3 credits

Prerequisites: ISE 330, ISE 470, STA 440. Systems of work measurement and work methods. Comparisons of systems.

ISE 632—Facilities Systems Design. 3 credits
Prerequisites: ISE 433, ISE 671. Facilities planning, including information analysis, man-machine requirements, facility location methodologies, material handling analysis, storage and warehousing, assembly line balancing, and physical distribution.

ISE 635—Health Systems Analysis 1. 4 credits
Industrial engineering approaches to hospital and health systems. Deterministic problems, including methods engineering, work measurement, production control, project planning, resource allocation, facilities design, and cost analysis.

ISE 636—Health Systems Analysis 2. 4 credits
Prerequisite: ISE 635. Continuation of ISE 635. Stochastic aspects of hospital and health systems and the influence of variability and uncertainty in health management decisions.

ISE 640—Human Factors Engineering. 3 credits
Prerequisite: A course in human engineering or perceptual psychology. Effects of human factors on the performance of systems containing extensive man-machine interactions.

ISE 641—Behavior Systems Engineering. 3 credits
Prerequisite: ISE 640. Behavioral and engineering principles underlying prediction and management of human behavior, design of organization systems, and development of synthetic behavior systems.

ISE 642—Man-Machine Systems Design. 3 credits
Prerequisite: ISE 640. Engineering design concepts of interfaces between man and machines.

ISE 650—Theory of Programming. 3 credits
Prerequisite: ISE 550. Theoretical and historic developments of modern digital computers, programming techniques, and software systems.

ISE 651—Digital Simulation Techniques. 3 credits
Prerequisite: ISE 550. Computer programming aspects of digital simulation. Use of simulation languages such as SIMSCRIPT or GPSS. Simulation of large-scale, mathematically indeterminate systems.

ISE 652—Dynamic Modeling and Simulation. 3 credits
Prerequisites: ISE 550, STA 660. Dynamic modeling and simulation methods for input-output analysis of complex systems. Computational techniques.

ISE 653—Information Systems. 3 credits
Prerequisite: ISE 550. Information systems, including an introduction to information theory and coding, document and reference retrieval, fact and information retrieval, measures of effectiveness, mathematical models of retrieval systems, and schemes for the storage of information.

ISE 654—Time Sharing Systems Design. 3 credits
Prerequisite: ISE 650. Special design considerations in hardware and software for time sharing. Multiprocessing, multiprogramming, static and dynamic reallocation, and remote terminal operation.

ISE 655—Software Systems Design. 3 credits
Prerequisite: ISE 650. Design and use of computer programming systems involving machine translated languages. Theory of compilers based on syntactic decomposition and recursive processing.

ISE 657—Analog Computer Techniques. 3 credits
Prerequisite: ISE 557. Analog computer techniques to study complex systems. Analog computer logic as an additional tool in problem solving. Boundary value problems and dynamic parameter optimization techniques.

ISE 658—Analog-Hybrid Systems. 3 credits

Prerequisite: ISE 657. Hybrid computer systems, both hardware and software. Sampling theory, quantizing theory, and error analysis. Hybrid computer techniques for solving partial differential equations and optimization problems. Examples of adaptive control systems.

ISE 659—Advanced Hybrid Computer Techniques. 3 credits

Prerequisite: ISE 557. Hybrid computer techniques superior to digital or analog techniques. Boundary value, dynamic parameter optimization, fluid network simulation, optimal control and techniques such as random search, steepest ascent, gradient methods, dynamic programming, and the maximum principle.

ISE 660—Statistical Quality Control. 3 credits

Prerequisites: STA 442 or 525; ISE 571. Theoretical basis for control charts on variables and attributes data. Cumulative Sum Control Charts. Mathematics of sampling plans for attributes and variables. Bayesian decision rules. Evolutionary operation.

ISE 661—Statistical Forecasting Models. 3 credits

Prerequisites: ISE 401, STA 442. Classification of models for forecasting. Polynomial and autoregressive models. Estimation of model parameters. Analysis of industrial data.

ISE 662—Reliability Theory. 3 credits

Prerequisites: Matrix theory, STA 442, ISE 562. Reliability models as a function of system configurations. Reliability prediction for various underlying component failure laws. Sensitivity analysis. Models of interdependent systems.

ISE 670—Mathematical Methods of Operations Research 1. 3 credits

Prerequisites: Matrix theory, transform theory, probability theory. Topics covered include theory of queues, classical optimization, and linear programming.

ISE 671—Mathematical Methods of Operations Research 2. 3 credits

Prerequisite: ISE 670. Continuation of ISE 670. Dynamic programming, nonlinear programming, the maximum principles, game theory, and decision theory.

ISE 680—Queuing Theory. 3 credits

Prerequisites: Matrix theory, transform theory, STA 660. Classification of queuing systems and waiting line problems. Model formulation. Analysis of selected systems. Applications to engineering systems.

ISE 681—Stochastic Service Systems. 3 credits

Prerequisite: ISE 670. Modeling of large-scale engineering systems. Input-output analysis. Methods of handling uncertainty. Optimum design.

ISE 684—Systems Analysis 1. 3 credits

Prerequisites: ISE 402, STA 440, EE 474. Review of linear systems. State variable methods for system analysis. Techniques of modeling. Computer methods. Application to control problems.

ISE 685—Systems Analysis 2. 3 credits

Prerequisite: ISE 580. Optimal control theory and system optimization techniques. Statistical methods of data analysis. Estimation theory. Kalman filtering.

ISE 686—Advanced Systems Design. 3 credits

Prerequisites: ISE 684, ISE 671, EE 570. Application of the techniques of operations research, control theory and systems analysis to the design of systems. Completion of a design project.

ISE 690—Graduate Seminar. 0 or 1 credit

May be repeated for additional credit.

ISE 691—Methods of Experimental Research. 3 credits

ISE 696—Special Problems. 1 to 9 credits
Laboratory, lecture, field work or conferences. May be repeated with change of content up to maximum of 18 credits.
ISE 699—Master's Research. 1 to 17 credits
ISE 797—Special Problems. 1 to 9 credits
Laboratory, lecture, field work or conferences. May be repeated with change of content up to a maximum of 18 credits.
ISE 799—Doctoral Research. 1 to 17 credits

JOURNALISM AND COMMUNICATIONS

GRADUATE FACULTY 1970-71

Jones, J. P., *Dean;* Christiansen, K. A.; Edwardson, M. N.; Griffith, J. L.; Griggs, H. H.; Hash, F. F.; Hooper, L. J.; Jacobs, A. J.; Webb, J. V.; Weimer, R. O.; Whittaker, R. D.

Graduate Coordinator: H. H. Griggs

The degree of Master of Arts in Journalism and Communications is offered. Specialization may be in advertising, communication research, educational broadcasting, international communication, journalism education, media management, news, public relations, radio, or television.

Prerequisite to admission is a bachelor's degree in advertising, broadcasting, journalism, or some allied field. The student who does not hold a degree in one of these fields may be required to complete satisfactorily the following undergraduate work: (1) for the advertising student, one course each in advertising principles, copy and layout, principles of marketing, radio-TV advertising, and advertising campaigns; (2) for the broadcasting student, a foundation in general communication: broadcast writing, production, programming, and news; (3) for the news or public relations student, two courses in reporting or writing and one course each in editing, photo journalism, history of mass communication, and law of the press.

Adequate preparation in the social sciences and humanities is required of each student. An introductory course in statistics is strongly recommended for all candidates as early as possible.

The minor field will be selected in consultation with the major adviser and will depend on the special needs of the student. Eight to 10 credits will qualify for the minor, although a minor of up to 18 credits will be permitted.

COM 601—Research Methods in Mass Communication and either COM 605—Seminar in Mass Communication and Society or COM 606—Seminar in Mass Communication Theory are required of all candidates. All students classified as 7JM may be required to register for COM 660—Communication Colloquium each quarter.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ADV 507—Public Opinion Theory and Advertising. 5 credits

ADV 512—Advertising Campaigns. 4 credits
BR 518—Teaching Through Television. 5 credits
BR 525—Television Staging and Lighting. 3 credits
BR 538—Radio, Television and Film Writing. 3 credits
JM 508—Public Opinion. 5 credits
JM 509—Law of the Press and Radio-TV. 4 credits
JM 515—Journalism in Secondary Schools. 5 credits
PR 514—Advanced Public Relations. 4 credits

GRADUATE COURSES

COM 601—Research Methods in Mass Communication. 4 credits
Bibliography and documentation, research planning, basic sampling procedures, opinion surveys, content analysis, readership/audience studies, historiography.

COM 602—Advertising Research Problems. 4 credits
Testing advertising appeals and efficiency, market analysis, consumer analysis.

COM 603—Broadcast Station Management. 4 credits
Station organization, operational policies, market research, programming policy, network affiliation, federal and state regulations governing the broadcasting industry, FCC procedures.

COM 604—Newspaper Production and Management. 4 credits
Newspaper business management, good will, budgets, accounting, labor problems, taxes, legal questions, postal regulations, newspaper promotion, circulation, advertising problems, weekly and small daily publishing.

COM 605—Seminar in Mass Communication and Society. 4 credits
Rights, responsibilities, ethics of communication media; government and communication media; economic, political, social determinants of the character and content of mass communication; relationship and competition among mass media.

COM 606—Seminar in Mass Communication Theory. 4 credits
Structure, content, process, effects of communication; contributions of other disciplines to knowledge about the process, e.g., semantics, linguistics, learning theory; barriers to effective communication; use of research concepts and findings.

COM 611—Seminar in History of Mass Communication. 4 credits
Reading, critical study, and advanced investigative report on an approved research subject in the history of mass communication.

COM 614—Problems in Public Relations. 4 credits
Specialized areas in public relations, case studies, community relations, analysis of public relations problems in the light of public relations and other communication theory.

COM 615—Seminar in Problems of News Gathering and Presentation. 4 credits
Internal problems of news media operation. Status of personnel, effects of technological developments, news decision making, defining objectivity, improving news coverage.

COM 616—Seminar in Journalism Teaching. 4 credits
Research and training for journalism teaching and supervision of student publications.

COM 619—International Communication. 4 credits
Channels of international communication, controls, the foreign correspondent, world news agencies, comparison of mass media in major regions of the world.

COM 620—Investigative Reporting. 4 credits
Current news issues in correlation with background social science courses; writing investigative, interpretive and editorial articles and columns; depth reporting.

COM 621—Advanced Research Methods. 4 credits
Prerequisites: COM 601; STA 520. Scientific method, experimental design, statistical measurement and analysis, advanced research methodology in mass communication.

COM 623—Broadcast Program and Production Problems. 4 credits
Lecture and laboratory in planning and production of complex programs.

COM 628—Radio and Television in Education. 4 credits
The broadcast media in public school education and adult education; current usages in direct and indirect teaching and continuing education.

COM 630—Individual Work. 1 to 5 credits
A reading or research course in such areas of mass communication as are needed by graduate students. May be repeated with change of content up to a maximum of 10 credits.

COM 660—Communication Colloquium. 1 credit
Research exchange, methodology, new techniques. May be repeated with change of content up to a maximum of 4 credits.

COM 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

COM 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

COM 699—Master's Research. 1 to 17 credits

LATIN AMERICAN STUDIES

A description of the several degree and certificate programs in Latin American Studies may be found in the section *Special Programs*. Listings of graduate faculty attached to the Center, as well as of courses other than those enumerated below, may be found in individual departmental descriptions and in the yearly *Bulletin* of the Center for Latin American Studies. Copies of the *Bulletin* may be obtained from the Director, Latin American Center, W. E. Carter, 319-B International Studies Building.

Graduate Coordinator: W. E. Carter

GRADUATE COURSES

LA 630—Individual Work. 3 to 5 credits
Reading or research in topics focusing on a Latin American area but cutting across disciplines. May be repeated with change of content up to a maximum of 15 credits.

LA 640—Latin American Area Seminar. 5 credits
Prerequisite: Latin American area concentration. A multidisciplinary approach to Latin American topics. May be repeated with change of content up to a maximum of 15 credits.

LW 678—Seminar in Law and Development: Latin America. 4 credits
Prerequisite: LW 694. Legal systems of the American republics; problems of

substantive law of selected countries. Reading knowledge of French, Portuguese, or Spanish is required. Open only to graduate students majoring outside the College of Law. Offered simultaneously with LW 677.

LW 694—Seminar Preparation. 1 credit
A prerequisite for each seminar.

LA 697—Supervised Research. 1 to 5 credits
Credit not applicable toward a degree. May be repeated.

LA 699—Master's Research. 1 to 17 credits

LIBRARY SCIENCE

GRADUATE FACULTY 1970-71

Harrer, G. A., *Chairman*; Youngs, M.

LY 615—Advanced Reference and Bibliography. 4 credits
Prerequisite: LY 415. Reference and bibliographic services and resources in the humanities and the social sciences.

LY 625—Advanced Cataloging and Classification. 4 credits
Prerequisite: LY 425. Principles of cataloging and classification with the L. C. system and subject headings illustrating practices in research and large public libraries. Includes historical survey, non-book materials, and current trends.

LY 630—Individual Work. 3 to 5 credits
Prerequisite: Consent of the department chairman. Supplements other graduate courses by providing directed reading and research in special areas of library science, primarily library books and journals.

LINGUISTICS

GRADUATE FACULTY 1970-71

Algeo, J., *Director;* Casagrande, J.; Der-Houssikian, H.; Dew, D.; Dwyer, R.; Harder, J. C.; Hardman-de-Bautista, M.; Jensen, P. J.; Lasley, M. M.; Markel, N. N.; McCarthy, K. M.; Paige, A.; Saciuk, B.; Scholes, R. J.; Sullivan, W. J.; Valk, M. E.

Graduate Coordinator: H. Der-Houssikian

Study leading to the degrees of Master of Arts and Doctor of Philosophy with a major in linguistics is available through an interdepartmental program in which the participating departments are Anthropology, English, Germanic and Slavic Languages and Literatures, Romance Languages and Literatures, and Speech. Graduate programs may emphasize linguistic theory, the descriptive or historical study of a single language or language group, anthropological linguistics, psycholinguistics, or experimental phonetics. A program in the teaching of English as a second language is available on the master's level.

Undergraduate Preparation: For admission to graduate work in linguistics, the student should have an undergraduate major in a language or language-related subject such as anthropology, psychology, or speech and

should have done basic work in general linguistics, phonetics, and English structure. Deficiencies in undergraduate preparation must be satisfied before the student can proceed to full-time graduate work.

Required of each candidate for the master's degree in linguistics are LIN 600, LIN 610, LIN 620, LIN 630, LIN 640, and structural knowledge of a language other than his native tongue. In addition, LIN 611 and LIN 621 are required of doctoral candidates, who must also meet the Graduate School foreign language requirement in one language and have structural knowledge of two others, including at least one year of study in a non-Western language.

In addition to the courses listed below, the following are available for graduate major credit in linguistics: APY 503, APY 506, EH 601, EH 602, EH 603, EH 604, EH 701, FLE 619, FH 504, FH 506, FH 512, FH 606, GN 512, GN 555, GN 620, GN 624, LN 620, PE 504, RSN 506, RSN 512, RSN 513, RSN 514, SH 504, SH 506, SH 512, SH 606, SCH 585, SCH 596, SCH 685, SCH 686, SCH 687, SCH 688, SCH 694, SCH 695, SCH 696, SCH 785, SCH 786, SCH 795, SCH 796.

For further information, see the Graduate Coordinator, or write the *Director, Program in Linguistics, Graduate and International Studies Building, University of Florida, Gainesville, Florida 32601.*

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

SI 506—The Structure of Swahili. 4 credits
LIN 550—Applied Linguistics. 4 credits

GRADUATE COURSES

LIN 600—Introduction to Graduate Study in Linguistics. 2 credits
The field of linguistics and its relation to other disciplines; bibliographical resources; methods of research; current issues in linguistics.

LIN 610—Phonology 1. 4 credits
Methods of phonological analysis and theories of phonology.

LIN 611—Phonology 2. 4 credits
Prerequisite: LIN 610. Language-specific phonological problems in relation to a language-independent theory of phonology.

LIN 620—Morphosyntax. 4 credits
Prerequisite: LIN 610. Morphological analysis and comparative introduction to current syntactic theories.

LIN 621—Syntax. 4 credits
Prerequisite: LIN 620. Syntactic and semantic systems of language.

LIN 624—Seminar in Linguistic Field Methods. 5 credits
Prerequisite: APY 503. Analysis of a particular language through an informant. May be repeated with change of content up to a maximum of 15 credits.

LIN 630—Historical Linguistics. 4 credits
Prerequisites: LIN 610, LIN 620. Theory and methods of historical-comparative linguistics.

LIN 640—History of Linguistics. 4 credits
Prerequisites: LIN 610, LIN 620. Linguistic thought from the pre-Socratics to the twentieth century.

LIN 660—Comparative Bantu Linguistics. 4 credits
Prerequisites: SI 506, LIN 620, and LIN 630; or consent of instructor.

LIN 690—Special Topics. 1 to 4 credits
Available topics include sociolinguistics, dialectology, lexicography, paralanguage and kinesics, linguistics and literature, and studies in particular languages such as Ukrainian, Chinese, Arabic, and Armenian. May be repeated with change of content up to a maximum of 16 credits.

LIN 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

LIN 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

LIN 699—Master's Research. 1 to 17 credits

LIN 799—Doctoral Research. 1 to 17 credits

MANAGEMENT AND BUSINESS LAW

GRADUATE FACULTY 1970-71

Wilmot, W. V., Jr., *Chairman*; Champion, J. M.; Fox, W. M.; Hill, W. A.; James, J. H.; Jennings, R. B.; Menke, W. W.; Ray, J. B.; Wallace, J.; Wyatt, J. W.

Graduate Coordinator: W. W. Menke

For admission to courses numbered 600 and above, the student must have been admitted to the Graduate School and normally should have had undergraduate courses in fields pertinent to the graduate courses selected; or, where necessary, special arrangements may be made with the approval of the department chairman.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

MGT 570—Production Management Problems. 5 credits

MGT 571—Managerial Operations Analysis 2. 4 credits

MGT 572—Managerial Operations Analysis 3. 4 credits

GRADUATE COURSES

MGT 601—Legal Problems of Management. 4 credits
Prerequisite: MGT 401. Special legal problems of business management.

MGT 610—Managerial Planning. 4 credits
Managerial functions of planning. Requirements and complexities of corporate planning activity. Development of the theoretical basis of the planning process.

MGT 611—Theory of Managerial Organization and Control. 4 credits
Organization and control theory; methods and procedures for regulating activities required to channel managerial operations within requirements of predetermined plans.

MGT 612—Organizational Behavior. 4 credits
Prerequisite: MGT 611. Empirical research methodology and findings of behavioral science applied in business management.

MGT 614—SEMINAR IN MANAGEMENT. 4 credits
Prerequisites: MGT 610, MGT 611. Historical foundations and evolutionary development of management concepts; comparative analysis of management patterns; emerging problems of management interests.

MGT 630—INDIVIDUAL WORK IN MANAGEMENT. 1 to 5 credits
Prerequisites: Permission of department and of the Director of Graduate Studies. Reading and/or research in management as needed by graduate students. May be repeated with change of content up to a maximum of 10 credits.

MGT 650—PERSONNEL TECHNIQUES AND ADMINISTRATION. 4 credits
Prerequisite: MGT 450. Realistic cases which point up the organizational, human relations, and administrative problems of the personnel administrator.

MGT 660—PROBLEMS IN COLLECTIVE BARGAINING. 4 credits
History, present status, and trends of collective bargaining, with an analysis of its economic, social, and legal aspects.

MGT 690—SPECIAL TOPICS IN MANAGEMENT. 4 credits
Prerequisite: Permission of department well in advance of registration. Topics more specialized or advanced than regularly listed courses.

MGT 699—MASTER'S RESEARCH. 1 to 17 credits

MARKETING

GRADUATE FACULTY 1970-71

BUTTERWORTH, J. D., *Chairman;* ANDERSON, A. A.; BOEWADT, R. J.; FARICY, J. H.; HESS, N. R.; LAMBERT, Z. V.; OSTERBIND, C. C.; SETTLE, R. B.; THOMPSON, R. B.

Graduate Coordinator: J. D. BUTTERWORTH

Though no graduate major may be completed without adequate course work on the 600 or higher level, MKG 451—Advertising Management may be taken for graduate major credit.

For admission to courses listed below, the student must have been admitted to the Graduate School and normally should have had undergraduate courses in fields pertinent to the graduate courses selected; or, where necessary, special arrangements may be made with the approval of the department chairman.

GRADUATE COURSES

MKG 621—INTERNATIONAL MARKETING 1. 5 credits
Prerequisite: MKG 531. Strategies leading to the penetration of foreign markets.

MKG 622—INTERNATIONAL MARKETING 2. 5 credits
Prerequisite: MKG 621. Continuation of MKG 621. Emphasis on developing market strategies for specific geographic areas.

MKG 630—INDIVIDUAL WORK. 1 to 5 credits
Prerequisite: Permission of department. Reading and/or research in marketing as needed by graduate students. May be repeated with change of content up to a maximum of 15 credits.

MKG 631—Seminar in Marketing Theory. 5 credits

Prerequisite: MKG 531. Advanced principles, theories and problems in marketing. Functional, institutional, cost, and historical approaches from both the social and firm points of view.

MKG 639—Seminar in Marketing Management. 5 credits

Prerequisite: MKG 531. Advanced case course dealing with the wide range of operational problems faced by the marketing manager.

MKG 652—Consumer Behavior. 5 credits

Methodology and findings in the social sciences applied to individual and aggregate behavior of consumers.

MKG 671—Seminar in Marketing Research. 5 credits

Prerequisites: MKG 531 and six credits of statistics or undergraduate marketing research. Designed to provide students with thorough understanding and practice in the application of the scientific method to the solution of marketing problems.

MKG 690—Special Topics in Marketing. 5 credits

Prerequisite: Permission of the department. Selected topics in marketing management, research, or theory.

MKG 699—Master's Research. 1 to 17 credits

MATHEMATICS

Bednarek, A. R., *Chairman;* Ault, J.; Bacon, P.; Blake, R. G.; Bowman, T. T.; Brechner, B. L.; Brooks, J. K.; Brooks, M. S.; Chen, S.; De Groot, J.; Drake, D. A.; England, W. T.; Hadlock, E. H.; Hale, M. P.; Hanson, T. H.; Hearsey, B. V.; Janos, L.; Keesling, J. E.; Kent, J. F.; Kim, D. S.; Luehr, C. P.; Martinez, J.; Mauldin, R. D.; Moore, T. O.; Morse, W. P.; Nelson, C. W.; O'Connor, J. L.; Passell, N.; Phelps, D. G.; Pirenian, Z.; Piziak, R.; Pop-Stojanovic, Z.; Rodriguez, R. S.; Saxon, S. A.; Schnare, P. S.; Selfridge, R. G.; Shult, E. E.; Sigmon, K. N.; Slotterbeck, O. A.; Soerensen, K.; Stadtlander, D.; Strecker, G. E.; Teply, M. L.; Tzeng, Z.; Varma, A. K.; Wallace, A. D.

Graduate Coordinator: K. N. Sigmon

In addition to the requirements of the Graduate School, the minimum prerequisite for admission to the program of graduate studies in mathematics is the completion with an average grade of B or better of at least 36 credits of undergraduate mathematics, including a full year of calculus and three quarters of appropriate work beyond the calculus. Students lacking part of the requirements will be required to make up the deficiency early in their graduate work.

Prerequisites to individual courses should be determined before registration by consultation with the instructor concerned through the departmental office.

Some of the courses listed are offered regularly, while others are offered only as needed. Since times for offering courses are estimated a year in advance, certain changes may be made if needs are known to the department.

The courses MS 551, MS 552, MS 553, MS 631, MS 632, MS 633, MS

641, MS 642, MS 643, MS 651, MS 652, MS 653, and either MS 661, MS 662, MS 663 or MS 681, MS 682, MS 683, and MS 671 are required in all doctoral programs, the latter for three quarters. Descriptions of the 500-level courses are to be found in the undergraduate catalog. Each doctoral candidate is required to take two advanced-level courses for which at least one of the basic advanced courses is a prerequisite. Doctoral candidates must pass reading knowledge examinations in two of the following foreign languages: French, German, or Russian.

Advanced mathematics courses are not necessarily numbered according to their difficulty. The 700 courses are those related more specifically to some particular field. Much of the advanced graduate training is done in MS 690. In recent years eight or more sections of 690 have been offered each quarter.

Every graduate student is expected to attend the regular colloquium.

Details concerning all requirements for graduate degrees in Mathematics can be obtained by writing to the Mathematics Department Graduate Selection Committee.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

MS 501—Intermediate Differential Equations for Engineers and Physical Scientists. 3 credits
MS 502—Vector Analysis. 3 credits
MS 503—Introduction to Complex Variables for Engineers and Physical Scientists 1. 3 credits
MS 504—Introduction to Complex Variables for Engineers and Physical Scientists 2. 3 credits
MS 505—Introduction to Partial Differential Equations. 3 credits
MS 507—Fourier Series and Transforms 1. 4 credits
MS 508—Fourier Series and Transforms 2. 4 credits
MS 531—Introductory Algebra 1. 3 credits
MS 532—Introductory Algebra 2. 3 credits
MS 533—Introductory Algebra 3. 3 credits
MS 541—Modern Analysis 1. 3 credits
MS 542—Modern Analysis 2. 3 credits
MS 543—Modern Analysis 3. 3 credits
MS 544—Theory of Differential Equations 1. 3 credits
MS 545—Theory of Differential Equations 2. 3 credits
MS 547—Advanced Calculus 1. 3 credits
MS 548—Advanced Calculus 2. 3 credits
MS 549—Advanced Calculus 3. 3 credits
MS 551—Proseminar 1. 4 credits
MS 552—Proseminar 2. 4 credits
MS 553—Proseminar 3. 4 credits
MS 555—Introduction to Analytic Functions 1. 3 credits
MS 556—Introduction to Analytic Functions 2. 3 credits
MS 561—Introduction to Topology 1. 3 credits
MS 562—Introduction to Topology 2. 3 credits

GRADUATE COURSES

MS 601—Real and Complex Variables for Engineers and Physical Scientists 1. 3 credits

Prerequisites: MS 501, MS 502, MS 504. First of a three-term course. Topics include: vector spaces, orthogonal functions, zeros of polynomials, asymptotic expansions, second order linear ordinary differential equations, and conformal mapping.

MS 602—Real and Complex Variables for Engineers and Physical Scientists 2. 3 credits

Prerequisite: MS 601. Continuation of MS 601.

MS 603—Real and Complex Variables for Engineers and Physical Scientists 3. 3 credits

Prerequisite: MS 602. Continuation of MS 602.

MS 604—Integral Transforms for Engineers and Physical Scientists. 3 credits

Prerequisite: MS 603. Distributions, Fourier and Laplace transforms, other integral transforms, applications.

MS 605—Linear Integral Equations for Engineers and Physical Scientists. 3 credits

Prerequisite: MS 601. Linear operators on Hilbert spaces, homogeneous Fredholm integral equations, nonhomogeneous Fredholm equations, Voltera integral equations, approximation methods.

MS 606—Introduction to Nonlinear Equations for Engineers and Physical Scientists. 3 credits

Prerequisite: MS 605. Algebraic and transcendental equations, nonlinear differential equations, nonlinear integral equations.

MS 607—Fourier Series 1. 3 credits

Prerequisite: MS 601. Fundamental theorems on convergence, differentiation, and integration. Applications to boundary value problems.

MS 608—Fourier Series 2. 3 credits

Prerequisite: MS 607. A continuation of MS 607.

MS 609—Introduction to Calculus of Variations for Engineers and Physical Scientists. 3 credits

Prerequisite: MS 601. Extremals for integrals with fixed endpoints, effect of varying endpoints, transversality condition, direct methods.

MS 610—Tensor Analysis. 3 credits

Prerequisites: MS 502, MS 601. The calculus of tensors with special attention to its application to differential geometry, problems from physics, and n-dimensional spaces.

MS 611—Applications of Group Theory in the Physical Sciences. 3 credits

Prerequisite: PS 647. Group theory, the theory of representations of groups and their relationship to the problems of physics.

MS 614—Numerical Analysis. 3 credits

Prerequisites: MS 411; MS 543 or MS 446. Designed to acquaint research students with numerical analysis, error analysis of differential equations, integral equations, eigenvalue, and matrix problems with study of errors.

MS 615—Partial Differential Equations 1. 3 credits

Prerequisites: MS 505; MS 543 or MS 603. Cauchy-Kowalewski theorem, first order equations, classification of equations, hyperbolic equations, elliptic equations,

parabolic equations, hyperbolic systems, nonlinear hyperbolic systems, existence theory based on functional analysis. Applications to partial differential equations arising from physical sciences.

MS 616—Partial Differential Equations 2. 3 credits
Continuation of MS 615.

MS 617—Partial Differential Equations 3. 3 credits
Continuation of MS 616.

MS 631—Algebra 1. 3 credits
Prerequisite: MS 533. Sylow theorems, solvable and nilpotent groups, Jordan-Holder theorem, abelian groups, Jacobson radical, Jacobson density theorem, Wedderburn-Artin theorem.

MS 632—Algebra 2. 3 credits
Prerequisite: MS 631. Continuation of MS 631.

MS 633—Algebra 3. 3 credits
Prerequisite: MS 632. Continuation of MS 632.

MS 635—Projective Geometry. 3 credits
Projective planes, perspectivity, and projectivity. Fundamental theorem, quadrangles, duality, cross ratio, polarities. Some famous theorems such as those of Pappus, Pascal, Branchon, etc.

MS 636—Non-Euclidean Geometry. 3 credits
Geometric foundation of Euclidean (and non-Euclidean) plane. Plane geometry, trigonometry, and calculus of non-Euclidean hyperbolic plane.

MS 637—Higher Geometry. 3 credits
Homogeneous point and line coordinates, projective coordinates, collineations, and correlations. Double points, circular points at infinity, conics, and involutions. Classification of geometries such as projective, affine, Euclidean, non-Euclidean, metric, finite, etc.

MS 638—Differential Geometry 1. 3 credits
Prerequisites: MS 502, MS 601. Recommended: MS 610. First part of a three-term sequence. Classical differential geometry of curves and surfaces, differentiable manifolds, tensor analysis, affine connection, Riemannian geometry, Lie groups, Lie algebras, applications to physics.

MS 639—Differential Geometry 2. 3 credits
Prerequisite: MS 638. Continuation of MS 638.

MS 640—Differential Geometry 3. 3 credits
Prerequisite: MS 639. Continuation of MS 639.

MS 641—General Theory of Measure and Integration 1. 3 credits
Prerequisite: MS 543. Measure and outer measures; extension, completion, and approximation of the measures; measurable functions; integration; signed measures; product spaces; approximate differentiation and differentials; applications; integration over locally compact spaces and locally compact groups.

MS 642—General Theory of Measure and Integration 2. 3 credits
Prerequisite: MS 641. Continuation of MS 641.

MS 643—General Theory of Measure and Integration 3. 3 credits
Prerequisite: MS 642. Continuation of MS 642.

MS 645—Advanced Topics in Integration 1. 3 credits
Prerequisites: MS 537, MS 643 and MS 663. Current topics in integration, reference to function spaces and to spaces provided with algebraic or topological structures.

MS 646—Advanced Topics in Integration 2. 3 credits
Prerequisite: MS 645. Continuation of MS 645.

MS 647—Advanced Topics in Integration 3. 3 credits
Prerequisite: MS 646. Continuation of MS 646.

MS 648—Mathematical Analysis for Statisticians. 4 credits
Corequisite: STA 610. Set theory, cardinality, metric spaces, limits, continuity, differentiation, approximation of functions, series of functions. Applications to probability and statistics are stressed.

MS 649—Mathematical Analysis for Statisticians. 4 credits
Prerequisite: MS 648. Measure and integration; additive set functions and measures; Lebesgue measure in R^n, Egorov's theorem, Lebesgue and Lebesgue-Stieltjes integrals, monotone convergence, dominated convergence, $\mathcal{L}^p$ spaces, Radon-Nikodym theorem, Fubini theorem, and Kolmogorov-Daniell theorems. Applications in probability and statistics.

MS 650—Mathematical Analysis for Statisticians. 4 credits
Prerequisite: MS 649. Matrix Theory: algebraic requirements for experimental designs, distribution theory and Markov processes. Fourier series: convergence results, Gibbs phenomenon, relation to time series. Characteristic functions: continuity, differentiability conditions, Helley's theorems, examples.

MS 651—Complex Analysis 1. 3 credits
Prerequisite: MS 543. Rapid survey of properties of complex numbers, linear transformations, geometric forms and necessary concepts from topology. Complex integration, Cauchy's theorem and its corollaries, Taylor's series and the implicit function theorem in complex form. Conformality and the Riemann-Caratheodory mapping theorem. Theorems of Bloch, Schottky and the big and little theorems of Picard. Harmonicity and Dirichlet's problem.

MS 652—Complex Analysis 2. 3 credits
Prerequisite: MS 651. Continuation of MS 651.

MS 653—Complex Analysis 3. 3 credits
Prerequisite: MS 652. Continuation of MS 652.

MS 661—Algebraic Topology 1. 3 credits
Prerequisites: MS 433, MS 553. Development of a homology or cohomology theory satisfying the Eilenberg-Steenrod axioms, with applications.

MS 662—Algebraic Topology 2. 3 credits
Prerequisite: MS 661. Continuation of MS 661.

MS 663—Algebraic Topology 3. 3 credits
Prerequisite: MS 662. Continuation of MS 662.

MS 671—The Journal Seminar. 1 credit
Prerequisite: MS 553. Reports on current periodical literature. May be repeated.

MS 675—Individual Work. 3 credits
May be repeated with change of content up to a maximum of 12 credits.

MS 676—Individual Work. 1 credit
May be repeated.

MS 681—General Topology 1. 3 credits
Prerequisite: MS 553. Product and quotient spaces, convergence, compactness and compactifications, connectedness, local and pathwise connectedness, separation axioms, complete regularity, normality, paracompactness, metrizability, and function spaces.

MS 682—General Topology 2. 3 credits
Prerequisite: MS 681. Continuation of MS 681.

MS 683—General Topology 3. 3 credits
Prerequisite: MS 682. Continuation of MS 682.

MS 690—Special Topics in Mathematics. 3 credits
Prerequisite: Permission of the graduate adviser, who should be consulted well in advance of registration. Topics previously offered include topological algebra foundations, relation theory, topological semigroups, differential topology, random functions and random fields, algebraic semigroups, functional analysis, category theory, projective planes, dimension theory, algebraic topology.

MS 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

MS 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

MS 699—Master's Research. 1 to 17 credits

MS 701—Binary Topological Algebra 1. 3 credits
Prerequisites: MS 533, MS 543, MS 553. Corequisite: MS 661. Structure of topological semigroups and related systems.

MS 702—Binary Topological Algebra 2. 3 credits
Prerequisite: MS 701. Corequisite: MS 662. Continuation of MS 701.

MS 703—Binary Topological Algebra 3. 3 credits
Prerequisite: MS 702. Corequisite: MS 663. Continuation of MS 702.

MS 745—Theory of Numbers 1. 3 credits
Prerequisites: Two of MS 633, MS 643, MS 653, MS 663. Introduction to the theory of numbers; theorems on divisibility; congruences, number-theoretic functions; primitive roots and indices; the quadratic reciprocity law; Diophantine equations and continued fractions.

MS 746—Theory of Numbers 2. 3 credits
Prerequisite: MS 745. Continuation of MS 745.

MS 747—Theory of Numbers 3. 3 credits
Prerequisite: MS 746. Continuation of MS 746.

MS 755—Algebraic and Functional Analysis 1. 3 credits
Prerequisites: MS 633, MS 643. Algebraic and topological approach to material and methods current in analysis. May be repeated once.

MS 756—Algebraic and Functional Analysis 2. 3 credits
Prerequisite: MS 755. Continuation of MS 755. May be repeated once.

MS 757—Algebraic and Functional Analysis 3. 3 credits
Prerequisite: MS 756. Continuation of MS 756. May be repeated once.

MS 765—Advanced Topics in Algebra 1. 3 credits
Prerequisites: MS 633; MS 643, MS 653, or MS 663. Current topics in algebra. May be repeated once.

MS 766—Advanced Topics in Algebra 2. 3 credits
Prerequisite: MS 765. Continuation of MS 765. May be repeated once.

MS 767—Advanced Topics in Algebra 3. 3 credits
Prerequisite: MS 766. Continuation of MS 766. May be repeated once.

MS 799—Doctoral Research. 1 to 17 credits

MECHANICAL ENGINEERING

GRADUATE FACULTY 1970-71

Gaither, R. B., *Chairman*; Allen, W. C.; Farber, E. A.; Gater, R. A.;

Hsieh, C. K.; Irey, R. K.; Mahig, J.; Oliver, C. C.; Piotrowski, G.; Roan, V. P., Jr.; Schwartz, F. L.; Sholtes, R. S.; Smith, H. B.; Tesar, D.; Tomas, J.; Vance, J. M.

Graduate Coordinator: R. K. Irey

Graduate programs are available leading to the degrees of Master of Science, Master of Engineering, Engineer, and Doctor of Philosophy. Areas in which students may specialize include acoustics, automatic controls, biomechanics, combustion, cryogenics, energy conversion, environmental control, fluid dynamics, gas dynamics, heat transfer, kinematic synthesis, machine dynamics, propulsion, solar energy, thermodynamics, and vibrations.

The following *Engineering Common Courses* are available for graduate major credit: EGC 541—Tensor Fields and Fluid Dynamics; EGC 601—Theory of Fluid Flow 1; EGC 602—Theory of Fluid Flow 2; EGC 603—Theory of Fluid Flow 3; EGC 604—Boundary Layer Theory; EGC 611—High Speed Gas Dynamics 1; EGC 671—Introduction to Plasmas; EGC 672—Plasma Theory.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ME 520—Control System Theory.	3 credits
ME 530—Marine Systems 1.	3 credits
ME 531—Marine Systems 2.	3 credits
ME 550—Gas Dynamics of Internal Flow Systems.	3 credits
ME 555—Intermediate Heat Transfer.	3 credits
ME 560—Statistical Thermodynamics.	3 credits
ME 561—Classical Thermodynamics.	3 credits
ME 579—Computer Simulation of Mechanical Systems.	3 credits
ME 580—Advanced Dynamics of Machinery.	3 credits
ME 581—Design Synthesis in Vibrations.	3 credits
ME 591—Gas Turbines and Jet Engines.	3 credits
ME 593—Mechanical Design 1.	3 credits
ME 594—Mechanical Design 2.	3 credits

GRADUATE COURSES

ME 620—Instrumentation and Measurements Laboratory. 1 credit
Methods of measuring properties most often encountered in modern research; actual measurement, rather than theory, emphasized.

ME 621—Feedback Control System Design 1. 3 credits
Design and compensation of linear feedback control systems. Mechanical, hydraulic, pneumatic, electromechanical systems.

ME 623—Feedback Control System Design 2. 3 credits
Design and compensation of linear and nonlinear feedback control systems. Process control, satellite attitude control, aerospace vehicle control.

ME 624—Feedback Control System Design 3. 3 credits
Design of linear and nonlinear feedback control systems by state space techniques. Optimal control, adaptive control.

ME 630—Sliding-Element Bearing Analysis and Design. 3 credits
Prerequisite: ME 450, ESM 311, or ASE 402. Theory and design analysis of hydrodynamic bearings, hydrostatic bearings, and solid lubricated sliding bearings.

ME 631—Rolling-Element Bearing Analysis and Design. 3 credits
Prerequisites: ME 482 and ME 483, or ESM 533. Theory and design analysis of ball bearings and roller bearings.

ME 650—Special Topics in Fluid Dynamics. 3 credits
Prerequisite: ME 652. Unconventional flows of current interest, free molecule flow, ionized gas flows and magnetohydrodynamics, jet mixing theory; diagnostics and experimental techniques.

ME 651—Special Topics in Heat Transfer. 3 credits
Prerequisite: ME 430. Theoretical evaluation of physical constants. Techniques needed for the solution of heat transfer problems involving all three modes. conduction, convection, and radiation.

ME 652—Thermodynamics of Fluid Flow 1. 3 credits
Prerequisite: EGC 611. Laws of mechanics, thermodynamics, and heat transfer combined to give general relationships for the solution and better understanding of flow phenomena.

ME 653—Thermodynamics of Fluid Flow 2. 3 credits
Prerequisite: ME 652. Continuation of ME 652.

ME 654—Thermodynamics of Fluid Flow 3. 3 credits
Prerequisite: ME 653. Continuation of ME 653.

ME 655—Conduction Heat Transfer. 3 credits
Prerequisites: MS 305, ME 430. Mathematical description of conduction. Solution of conduction problems by series, transform, and numerical methods in generalized unsteady systems with appropriate boundary conditions.

ME 656—Convective Heat Transfer 1. 3 credits
Prerequisite: ME 655. Corequisite: EGC 603. Conservation equations for continuum fluids. Exact and approximate solutions for laminar flow. Analogies for turbulent flow.

ME 657—Radiation Heat Transfer. 3 credits
Prerequisites: MS 305, ME 430. Physics of radiation, general integral equations, simplified analyses for diffuse and gray surfaces. Equation of transfer and simplified participating gas analysis. Free molecule flow heat transfer.

ME 658—Convective Heat Transfer 2. 3 credits
Prerequisite: ME 656. Heat transfer analysis of multiphase and multicomponent fluid systems. Consideration of mass transport and chemical kinetics. Radiation coupling.

ME 659—Advanced Heat Transfer. 3 credits
Prerequisites: ME 657, ME 658. Modern developments. Interaction phenomena.

ME 660—Advanced Statistical Mechanics and Kinetic Theory. 3 credits
Prerequisite: ME 560. Highly degenerate Bose and Fermi systems. Statistical mechanics of dependent particles. The Boltzmann transport equation and transport properties.

ME 661—Advanced Thermodynamics. 3 credits
Thermodynamics of non-simple systems. Multicomponent and multiphase thermodynamic analysis.

ME 662—Irreversible Thermodynamics. 3 credits
Prerequisites: ME 661, ME 656. General equations of conservation for hetero-

geneous, non-simple reacting continua. Constitutive equations in general. Onsager reciprocity theorem. Example applications in mixed potential systems.

ME 663—Energy Conversion. 3 credits

The conversion of available forms of energy into mechanical and electrical forms; energy conversion schemes, including conventional cycles in unusual environments, MHD, solar cells, thermionic and photogalvanic conversion and fuel cells. May be repeated with change of content up to a maximum of 6 credits.

ME 664—Combustion 1. 3 credits

Prerequisites: ME 560, ME 561. Chemical reactions in gases, reactive gas dynamics, and general combustion phenomena, including vessel explosions, gas-phase diffusion flames, and droplet and particle combustion.

ME 665—Combustion 2. 3 credits

Prerequisite: ME 664. Premixed gas flames, aerodynamics of flames, detonation, heterogeneous combustion, supersonic combustion, and solid and liquid propellant combustion in rockets.

ME 666—Solar Energy Utilization. 3 to 6 credits

Solar energy; its availability and characteristics; its conversion and utilization as heat for power, refrigeration, distillation, photochemical reactions; solar energy as a research tool. May be repeated with change of content up to a maximum of 6 credits.

ME 667—Special Topics in Solar Energy 3 credits

Prerequisite: Undergraduate course in thermodynamics and heat transfer. Selective surfaces, solar traps, solar energy storage, solar fuel cells, direct conversion of solar radiation. May be repeated with a change of content up to a maximum of 9 credits.

ME 668—Gas Turbine Design and Performance. 3 credits

Prerequisite: ME 591. Design of gas turbine components and advanced performance calculations, based on best available gas properties and coordinated with actual data on large gas turbines, jets.

ME 675—Advanced Air Conditioning 1. 3 credits

Air conditioning system selection and system design; air handling techniques including noise control, cleaning, temperature and humidity control; modern technological development and economic analysis.

ME 676—Advanced Air Conditioning 2. 3 credits

Prerequisite: ME 675. Industrial applications, special requirements for hospitals, schools; survival shelter criteria.

ME 677—Advanced Refrigeration. 3 credits

Refrigeration methods and application to specific needs; design of refrigeration devices and systems; new concepts.

ME 680—Dynamics of Machine Systems. 3 credits

Prerequisite: ME 381. Applications of theory and iterative approximations in the analysis, synthesis, and design of high-speed machine units in which dynamic loads predominate.

ME 681—Mechanical Vibrations 1. 3 credits

Linear and torsional vibrations; systems of one or more degrees of freedom; vibrations absorbers and dampers.

ME 682—Mechanical Vibrations 2. 3 credits

Prerequisite: ME 681. Vibration analysis of multicylinder engines, rotating machinery, and flexible members in linkages.

ME 683—Dynamic Synthesis of Direct Contact Mechanisms. 3 credits

Prerequisite: ME 483. The design of direct contact mechanisms by classical techniques of rigid body systems and finite differences applied to systems composed of elastic components.

ME 684—Coplanar Kinematic Synthesis 1. 3 credits

Prerequisite: ME 381. Multiply separated position theory for 3, 4, and 5 positions of the moving system. Curvature transformation, circle point curves, and Burmester point theory. Treatment is analytical with emphasis on the theory of algebraic curves.

ME 685—Coplanar Kinematic Synthesis 2. 3 credits

Prerequisite: ME 684. Application of theory in ME 684. Point-path, coplanar, and function generation synthesis problems for linear, circular, or geared constraints. Reduction of parameters and optimization concepts.

ME 686—Spatial Kinematic Synthesis and Analysis. 3 credits

Geometry of motion in three dimensions. Single position design depending on orders of contact with spatial curves. Finitely separated position design by matrix methods. Synthesis and analysis of spatial motions.

ME 687—Computer-Aided Design: Optimization. 3 credits

Prerequisites: ISE 470, ME 579. Parameter optimization techniques in machine systems. Classical methods. Application of linear and nonlinear programming.

ME 689—Similitude in Mechanical Engineering Design. 3 credits

Principles of similitude for model design, analysis, and design analogies. Similitude as a basis for design optimization.

ME 690—Mechanical Research 1. 1 to 3 credits

Research projects in mechanical engineering. May be repeated with change of content up to a maximum of 6 credits.

ME 691—Mechanical Research 2. 1 to 3 credits

Prerequisite: ME 690. Continuation of ME 690. May be repeated with change of content up to a maximum of 6 credits.

ME 692—Advanced Mechanical Laboratory 1. 3 credits

Experimental projects in mechanical engineering.

ME 693—Advanced Mechanical Laboratory 2. 3 credits

Continuation of ME 692.

ME 695—Graduate Seminar. 1 credit

May be repeated with change of content up to a maximum of 9 credits.

ME 699—Master's Research. 1 to 17 credits

ME 799—Doctoral Research. 1 to 17 credits

MEDICAL SCIENCES—GENERAL

Programs leading to the Doctor of Philosophy degree in the basic medical sciences with a major in immunology and medical microbiology, neuroscience, pathology, pharmacology, and physiology are offered by the College of Medicine. In addition, a program in radiation biophysics leading to a Master of Science degree is available. Training in these scientific disciplines is planned to prepare the student for a career in research and teaching, rather than in clinical practice, for which the Doctor of Medicine degree program is designed. A minor is not required but may be chosen in another of the basic sciences listed below or elsewhere in the University. All facilities

of the College of Medicine are available to graduate students in this program. Though an undergraduate major in biological or physical science is desirable, concentration in mathematics or engineering is an appropriate foundation for the Doctor of Philosophy degree in medical sciences. Satisfactory completion of a thesis based on research is a requirement for a graduate degree in the medical sciences (see *College of Medicine Catalog*). A joint program with the Division of Biological Sciences is available in Cellular and Molecular Biology.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

MED 539—Introduction to Medical Sciences. 4 credits
MED 540—Cell Biology. 11 credits
MED 541—Cell Biology Laboratory. 1 to 6 credits
MED 545—Human Systems 1. 15 credits
MED 546—Human Systems 2. 15 credits

GRADUATE COURSES

MED 630—Research in Medical Sciences. 1 to 15 credits
Supervised research other than that for the thesis or dissertation in immunology and medical microbiology, neuroscience, pathology, physiology, pharmacology, and radiation biophysics. May be repeated with change of content up to a maximum of 15 credits.

MED 697—Supervised Research: Immunology and Medical Microbiology, Neuroscience, Pathology, Pharmacology, Physiology, and Radiation Biophysics. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

MED 698—Supervised Teaching: Immunology and Medical Microbiology, Neuroscience, Pathology, Pharmacology, Physiology, and Radiation Biophysics. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

MED 699—Master's Research: Immunology and Medical Microbiology, Neuroscience, Pathology, Pharmacology, Physiology, and Radiation Biophysics. 1 to 17 credits

MED 799—Doctoral Research: Immunology and Medical Microbiology, Neuroscience, Pathology, Pharmacology, and Physiology. 1 to 17 credits

METALLURGICAL AND MATERIALS ENGINEERING

GRADUATE FACULTY 1970-71

Rhines, F. N., *Chairman*; Baldwin, D. H.; DeHoff, R. T.; Dove, D. B.; Gould, R. W.; Guy, A. G.; Hartley, C. S.; Hench, L. L.; Hren, J. J.; Hummel, R. E.; Kronsbein, J.; Loehman, R. E.; Reed-Hill, R. E.; Tiffin, W. T.; Verink, E. D., Jr.; Whitney, E. D.

Graduate Coordinator: R. E. Reed-Hill

The minimum basic requirement for admission to the graduate program in metallurgical engineering is a bachelor's degree in metallurgical engineering, a related field of engineering, or science. Those graduate students who can present the prerequisites for the graduate courses in metallurgy, without having to schedule more than 18 credits in advanced undergraduate metallurgy, will be considered to have fulfilled this requirement. Each candidate for the doctorate, registering as a graduate student for the first time at the University of Florida, may be required to take a comprehensive examination in the field of metallurgical engineering. The purpose of this examination is to facilitate the planning of the candidate's graduate program.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

MTL 510—Electronic Structure of Matter. 3 credits
MTL 511—Electronic Structure and Properties of Crystals 1. 3 credits
MTL 512—Electronic Structure and Properties of Crystals 2. 3 credits
MTL 520—Structure and Properties of Alloys. 3 credits
MTL 521—Solid-State Processes. 3 credits
MTL 522—Selection of Materials. 3 credits
MTL 540—Mechanical Metallurgy 1. 4 credits
MTL 541—Mechanical Metallurgy 2. 3 credits
MTL 542—Metal Forming. 4 credits
MTL 550—Chemical Metallurgy 1. 3 credits
MTL 551—Corrosion. 3 credits
MTL 552—Chemical Metallurgy 2. 3 credits
MTL 560—X-Ray and Electron Metallography. 4 credits
MTL 580—Physical Ceramics 1. 3 credits
MTL 581—Physical Ceramics 2. 3 credits
MTL 582—Physical Ceramics 3. 3 credits
MTL 595—Special Topics in Metallurgical and Materials Engineering. 3 credits. Maximum 6 credits

GRADUATE COURSES

MTL 601—Advanced Phase Diagrams 1. 3 credits
Prerequisite: CY 453. Phase diagrams considering systems with as many as four components; emphasis on pressure-temperature-composition diagrams.

MTL 602—Advanced Phase Diagrams 2. 3 credits
Prerequisite: MTL 601. Continuation of MTL 601.

MTL 610—Theory and Properties of Metals and Alloys 1. 3 credits
Prerequisite: PS 644 or CY 641. Theory and structure of the free atom and assemblies of atoms; relationship of binding in solids to alloy formation, structures of metals and alloys, physical properties of metals and alloys.

MTL 611—Theory and Properties of Metals and Alloys 2. 3 credits
Prerequisite: MTL 610. Continuation of MTL 610.

MTL 612—Theory and Properties of Metals and Alloys 3. 3 credits
Prerequisite: MTL 611. Continuation of MTL 611.

MTL 615—Optical Properties of Metals and Alloys. 3 credits
Prerequisite: MTL 510. Optical properties by reflection, refraction, and absorption; methods for determining the optical constants of metals; relations between optical and electric constants; atomistic theory of the optical constants; optical properties in metal research.

MTL 617—Growth, Structure and Properties of Thin Films. 3 credits
Preparative techniques, structural characteristics and electronic properties of metallic, semiconducting and dielectric films.

MTL 620—Advanced Physical Metallurgy 1. 3 credits
Prerequisite: MTL 520. Kinetics of metallurgical processes; nucleation and growth, particle coarsening, martensite transformations, annealing, and sintering processes.

MTL 621—Advanced Physical Metallurgy 2. 3 credits
Prerequisite: MTL 520. Continuation of MTL 620.

MTL 622—Advanced Physical Metallurgy 3. 3 credits
Prerequisite: MTL 520. Continuation of MTL 621.

MTL 625—Diffusion in Solids. 3 credits
Prerequisite: MTL 520. Physical basis, equations, and theories of diffusion; tracer, chemical, multicomponent, and multiphase diffusion; diffusion in general force fields.

MTL 630—Radiation Damage in Solids. 3 credits
Action of thermal neutrons and fast particles upon solids, property changes by irradiation in pure metals and alloys, irradiation effects in semiconductors and ionic crystals; radiation phenomena in quartz, insulators, electronic devices and fissionable materials.

MTL 640—Advanced Mechanical Metallurgy 1. 3 credits
Prerequisite: MTL 540. Theory of elasticity; advanced theory of plasticity; theory and properties of dislocations; dislocation motion and interactions; application to deformation processes; survey of recent advances in the field.

MTL 641—Advanced Mechanical Metallurgy 2. 3 credits
Prerequisite: MTL 640. Continuation of MTL 640.

MTL 642—Advanced Mechanical Metallurgy 3. 3 credits
Identical with ESM 642. Prerequisite: MTL 641. Continuum theory of dislocation. Stress fields, displacement fields, and energies of simple shapes and finite arrays of dislocations. Continuous distributions of dislocations and their relationship to mechanical properties. Relation of the state of dislocation to the geometry of deformed lattices.

MTL 650—Metallurgical Thermodynamics. 3 credits
Prerequisite: MTL 550. Thermodynamics of metallurgical systems; surfaces in solids, irreversible processes.

MTL 651—Advanced Topics in Corrosion. 3 credits
Prerequisite: MTL 551. Theories and mechanisms of corrosion. Current literature on oxidation and corrosion.

MTL 660—Advanced X-Ray Diffraction 1. 3 credits
Prerequisite: MTL 560. X-ray diffraction as applied to materials.

MTL 661—Advanced X-Ray Diffraction 2. 3 credits
Prerequisite: MTL 660. Continuation of MTL 660.

MTL 662—Transmission Electron Microscopy. 3 credits
Prerequisite: MTL 560. Kinematical theory and dynamical theory of contrast from thin crystalline foils.

MTL 670—Seminar in Metallurgy. 1 credit
May be repeated with change of content.
MTL 671—Seminar in Metallurgy and Ceramic Science. 1 to 2 credits
MTL 675—Special Topics in Metallurgical Engineering. 1 to 6 credits
May be repeated with change of content up to a maximum of 9 credits.
MTL 680—Atomic Processes in Crystalline Ceramics. 3 credits
Prerequisite: CY 451. Ionic and covalent bonding, crystalline defect state, diffusion, ionic conductivity, and phase transformations in ceramics. Reactions of solids, gases, and liquids within ceramic systems.
MTL 681—Electronic Processes in Crystalline Ceramics. 3 credits
Introductory quantum and statistical mechanics and zone theory. Theory of semiconductor, dielectric, magnetic and optical properties in ceramic systems. Control of properties through microstructure and processing.
MTL 682—Structure and Properties of Glasses. 3 credits
Theory of glass structures, spinodal decomposition, nucleation and growth. Influence of compositions and thermal treatment on glass properties.
MTL 699—Master's Research. 1 to 17 credits
MTL 799—Doctoral Research. 1 to 17 credits

MICROBIOLOGY

GRADUATE FACULTY 1970-71

Tyler, M. E., *Chairman;* Bleiweis, A. S.; Duggan, D. E.; Hoffman, E. M.; Koburger, J.; Nasser, D. S.; Previc, E.; Schneider, N. J.; Smith, K. L.; Smith, P. H.

Graduate Coordinator: P. H. Smith

Graduate study is offered leading to the Master of Science and Doctor of Philosophy degrees in microbiology. Instruction and guidance is collaborative among faculty in Arts and Sciences, Agriculture, Medicine, and the Florida Bureau of Laboratories.

Prerequisites for admission to graduate study, in addition to those of the Graduate School, are a broad educational base including mathematics, physics and chemistry through organic and analytical; basic courses in botany and zoology; and preferably at least one course in bacteriology. An undergraduate major in a physical science, engineering, or general biology is usually acceptable. Receipt of an advanced degree requires detailed knowledge in biology, microbiology, and chemistry; undergraduate deficiencies may require additional study prior to completion of graduate work.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

MCY 505—Basic Immunology. 5 credits
MCY 506—Bacterial Pathogens. 5 credits
MCY 507—Microbial Ecology. 5 credits
MCY 510—General Virology. 5 credits

MCY 519—Microbial Chemistry: Structure and Physiology. 5 credits
MCY 520—Microbial Chemistry: Metabolism. 5 credits
MCY 521—Microbial Chemistry: Genetics. 5 credits

GRADUATE COURSES

MCY 650—Public Health Microbiology. 1 to 6 credits
Identical with MED 650. Prerequisites: Consent of department chairman and director of laboratories. Reference study and laboratory practice of diagnostic techniques in the Microbiological Diagnostic Laboratory of the Shands Teaching Hospital of the University of Florida Health Center or in residence at the Bureau of Laboratories, State Department of Health, Jacksonville, Florida. May be repeated with change of content up to a maximum of 18 credits.

MCY 651—Special Topics in Microbiology. 3 credits
Identical with MED 651. Prerequisite: 6 credits in graduate major courses. Contemporary research in a particular aspect of general microbiology. May be repeated with change of content up to a maximum of 6 credits.

MCY 652—Virology. 5 credits
Identical with MED 652. Selected topics on modern concepts of the nature of viruses and mechanism of viral infection, chosen from the field of animal, bacterial, and plant viruses.

MCY 653—Virology Laboratory. 3 credits
Identical with MED 653. Prerequisite or corequisite: MCY 652. Selected laboratory experiments concerned with the nature of viruses and mechanisms of viral replication and other consequences of viral infections.

MCY 654—Research Planning. 5 credits
Identical with MED 654. Prerequisite: 20 credits in progressive study of microbiology. Processes involved in scientific research, including initiating a problem, experimental techniques, analyses and evaluation of data, and reporting, illustrated by bacteriological examples.

MCY 655—Experimental Microbiology. 2 to 5 credits
Identical with MED 655. Prerequisite: 12 credits of microbiology. Application of physical, chemical, and biological techniques to experimental problems in microbiology. Individual laboratory study. May be repeated with change of content up to a maximum of 8 credits.

MCY 656—The Literature of Microbiology. 3 credits
Identical with MED 656. Prerequisite: 12 credits of microbiology. Bibliographic method in searching the literature. Literature of specified areas of the discipline.

MCY 657—Microbial Metabolism. 5 credits
Identical with MED 657. Prerequisite: BCH 603. Intermediary metabolism of microorganisms emphasizing those metabolic pathways that are unique or characteristic primarily of microorganisms.

MCY 658—Microbial Physiology. 5 credits
Identical with MED 658. Prerequisite: MCY 657. Structural and functional elements of microorganisms and mechanics of their regulatory systems. Mechanisms of control of microbial DNA replication, cell division, ribosome and cell-wall formation, kinetic studies of normal and abnormal growth.

MCY 659—Principles of Immunology. 5 credits
Identical with MED 659. Prerequisite: MCY 505 or MED 551. Biological and

biochemical aspects of host resistance and immunity. Chemical and physicochemical properties of the proteins of immune reactions.

MCY 660—Immunology Laboratory. 3 credits
Identical with MED 660. Prerequisite: Consent of staff. Corequisite: MCY 659.

MCY 661—Biology of Uncommon Microorganisms. 5 credits
Identical with MED 661. Prerequisite: MCY 302. Natural distribution, metabolic activities, isolation, and culture of selected groups of microorganisms.

MCY 662—Microbial Genetics. 5 credits
Identical with MED 662. Prerequisites: MCY 521, general genetics. Microbial genetics, including mutation, selection, transformation, transduction, conjugation, and episomal factors; molecular structure and function of genes.

MCY 663—Parasitic Diseases of the Tropics and Subtropics. 5 credits
Identical with MED 663, VY 663, ZY 663. Animal parasitology covering mechanisms of parasitic infections, physiology of parasites, and immune responses of the host.

MCY 664—Viral Diseases. 3 credits
Identical with MED 664. Prerequisite: MCY (MED) 652. Pathogenesis of viral disease, including cytopathic and oncogenic viruses. Diagnostic and preventive measures.

MCY 666—Microbiology 1. 6 credits
Identical with MED 666. Intensive review of principles of immunity, physiology, and genetics of bacteria, virology, infection, and ecology.

MCY 667—Microbiology 2. 3 credits
Identical with MED 667. Continuation of MCY 666.

MCY 668—Regulation in Biological Systems. 5 credits
Identical with MED 668. Prerequisites: MCY 520, MCY 521, MCY 657; BCH 601, BCH 602. Control of enzyme activity: kinetic, structural, inhibition (allosteric and non-allosteric), and energy level control; permeases; control of enzyme synthesis: positive and negative; repression, induction, catabolic repression, cyclic AMP; hormonal control.

MCY 669—Seminar. 1 credit
Identical with MED 669. Attendance required of all graduate majors at one student and one non-student presentation each week as scheduled. Jointly with Department of Microbiology. May be repeated with change of content.

MCY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

MCY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

MCY 699—Master's Research. 1 to 17 credits

MCY 799—Doctoral Research. 1 to 17 credits

MUSIC

GRADUATE FACULTY 1970-71

Poole, R., *Chairman*; Bodine, W. R.; Bolles, R. S.; Bowles, R. W.; Danburg, R. L.; Hale, J. P.; Keister, E. J.; Kushner, D. Z.; Troupin, E. C.; Wilmot, D. L.

Graduate Coordinator: J. P. Hale

The Department of Music cooperates with the College of Education in offering courses leading to the degree Master of Education with a major in music education.

The prospective candidate for the degree must satisfy admission requirements in the areas of applied music, music theory, music history and literature, and conducting, and satisfy requirements for music teaching certification in Florida. The certification requirement may be waived for admission but must be satisfied before the degree is awarded. All deficiencies must be remedied.

For additional courses in music education, see course listings: ED 663, ED 664, ED 665, ED 666, ED 667.

GRADUATE COURSES

MSC 600—Graduate Music Seminar. 0 credit
Required every term of all graduate students in music for a minimum of three terms.

MSC 609—Topics in Music Theory. 4 credits
Work culminating in a musical composition, arrangement, research paper, or public lecture-performance. Topics vary in different terms. May be repeated with change of content up to a maximum of 12 credits.

MSC 611—Methods of Musical Research and Bibliography. 4 credits
Materials and specialized techniques of research in musicology.

MSC 612—Methods of Research in Music Education. 4 credits
Materials and specialized techniques of research in music education.

MSC 615—Topics in Musicology. 4 credits
Work culminating in a research paper or article or in the public performance of a musical work of historical importance. Topics will vary in different terms. May be repeated with change of content up to a maximum of 12 credits.

MSC 616—Topics in Music Literature. 4 credits
Intensive study of specialized areas of music literature. Topics will vary in different terms. May be repeated with change of content up to a maximum of 12 credits.

MSC 621—Applied Music. 3 credits
Offered in piano, voice, organ, harpsichord, and all standard band and orchestral instruments. Recital appearance required each term. May be repeated with change of content up to a maximum of 9 credits.

MSC 630—Projects and Problems in Music. 5 credits
Approved problems for study and research. May be repeated with change of content up to a maximum of 15 credits.

MSC 667—Topics in Music Education. 4 credits
Study of selected areas of music education culminating in a research paper or article. Topics vary in different terms. May be repeated with change of content up to a maximum of 12 credits.

MSC 669—Music in the Schools. 2 to 9 credits
Offered by extension only. In-service training for teachers. Topics and projects vary. May be repeated with change of content up to a maximum of 9 credits.

MSC 670—Graduate Ensemble. 1 credit
For graduate students holding positions of leadership and participating in music ensembles. Credit not applicable toward graduate degree.

MSC 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
MSC 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

NEUROSCIENCE

GRADUATE FACULTY 1970-71

King, F. A., *Chairman;* Bernstein, J. J.; Feldherr, C. M.; Isaacson, R. L.; Larkin, A. R. S.; Larkin, L. H.; Vierck, C. J., Jr.

Graduate Coordinator: F. A. King

The Department of Neuroscience offers a program leading to the Doctor of Philosophy Degree in the basic neural sciences. Undergraduate preparation should include credits in biological science, chemistry, physics, mathematics and behavioral sciences. Deficiencies may be remedied by undergraduate courses, individual work, or special examination during the first year of graduate training. Required courses for most graduate students will include MED 534, MED 600, MED 633, and MED 676. The remainder of the graduate prorgam will consist of laboratory research and courses and seminars from this and other departments which have been selected jointly by the student and his advisory committee.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

MED 501—Gross Anatomy. 6 credits
MED 502—Applied Gross Anatomy. 7 credits
MED 503—Microscopic Anatomy. 6 credits
MED 534—Neurosciences. 6 credits

GRADUATE COURSES

MED 600—History of the Neurosciences. 3 credits
Prerequisite: Consent of instructor. Discoveries, concepts, and technical advances in the basic nervous system disciplines from ancient to modern times. Emergence of the several neurosciences as experimental disciplines providing a foundation for rational medical applications.

MED 601—Seminar: Somesthesis and Pain. 4 credits
Current research on central nervous system coding and information transfer, using somesthesis as a model with particular emphasis on pain.

MED 602—Teratology. 2 credits
Prerequisite: ZY 310 or MED 609. Theories of mechanisms in teratogenesis. May be repeated with change of content up to a maximum of 4 credits.

MED 603—Comparative Neurology. 4 credits
Prerequisite: MED 534. Phylogenetic development of the central nervous system of vertebrate animals considered from the behavioral, anatomical, and physiological points of view.

MED 604—Advances in Submicroscopic Anatomy. 4 credits

Prerequisites: Histology or cytology; approval of the staff. Ultrastructure in cells and tissues of vertebrate forms. Current research trends and functional connotations where pertinent.

MED 605—Research Methods in Anatomy. 1 to 6 credits

Research techniques of histochemistry, radiation biology, experimental embryology, teratology, experimental neurology, endocrinology, or electron microscopy under supervision of a staff member. May be repeated with change of content up to a maximum of 12 credits.

MED 606—Anatomy Seminar. 1 to 3 credits

MED 608—Special Topics in Anatomy. 1 to 6 credits

Readings in the recent research literature of anatomy and allied disciplines. May be repeated with change of content up to a maximum of 15 credits.

MED 609—Embryology and Organogenesis. 4 credits

Prerequisite: ZY 309 or MED 501. Human and higher mammalian development, with emphasis on maldevelopment. Physiological and clinical considerations stressed where pertinent.

MED 632—Techniques in Electron Microscopy. 3 to 5 credits

Prerequisites: Histology and cytology. Proficiency acquired in techniques of specimen preparation and analysis for ultrastructure investigation and in use of the ultramicrotome, high vacuum evaporator, and electron microscope.

MED 633—Neurobiology. 5 credits

Prerequisite: Background in biological or behavioral sciences. Structure and physiology of the nervous system as it pertains to control of behavior.

MED 634—Experimental Teratology. 5 credits

Prerequisites: Embryology; approval of the faculty. Laboratory experience in the effects of teratogenic agents on development. May be repeated with change of content up to a maximum of 10 credits.

MED 635—Comparative Endocrinology. 4 credits

Prerequisites: MED 503, ZY 551. Phylogenetic development of selected endocrine systems of vertebrate animals. Phylogeny of cell systems, correlated with mechanisms of functional activity.

MED 675—Manifestation and Management of Congenital Malformations. 4 credits

Prerequisites: ZY 306 or MED 609 or MED 602; approval of instructor. A theoretical and practical course in the incidences, relationship, repair and sequellae of structural abnormalities in man and other mammals.

MED 676—Neurohistology. 4 credits

Prerequisites: MED 534 and consent of instructor. Histological approaches and techniques for the study of the neuronal, neuroglial, and mesenchymal cellular components of the central and peripheral nervous system.

MED 677—Nerve as a Tissue. 2 credits

Prerequisite: Permission of instructor. Seminar on current research problems in the area of cellular interactions in the nervous system. Readings and discussion from articles in the fields contributing to the physiology, chemistry and anatomy of the nervous system.

MED 678—Advanced Microscopic Anatomy. 4 to 6 credits

Prerequisites: MED 503 or ZY 521; consent of instructor. Histological approaches and techniques relevant to selected research areas. Lectures, microscopic study, and laboratory project relating structural and functional aspects of a problem.

MED 679—Advanced Gross Anatomy. 3 to 6 credits

Prerequisite: Permission of instructor. Regional and specialized anatomy of the human body taught by laboratory dissection, conferences, and demonstrations. May be repeated with change of content up to a maximum of 9 credits.

MED 695—Advances in Cellular and Molecular Biology 1. 2 credits

Identical with BLY 602. The relationship between cell structure and function: 1) organization of chromosomes, RNA synthesis, and translation of the genetic code into functional entities; 2) organization of cellular membranes; 3) ultrastructure, function, and biosynthesis of sub-cellular organelles; 4) regulatory mechanisms of the cell; correlation of *in vitro* and *in vivo* experiments.

MED 696—Advances in Cellular and Molecular Biology 2. 2 credits

Identical with BLY 603. Prerequisite: MED 695. The relationship between cell structure and function: 1) organization of chromosomes, RNA synthesis, and translation of the genetic code into functional entities; 2) organization of cellular membranes; 3) ultrastructure, function and biosynthesis of sub-cellular organelles; 4) regulatory mechanisms of the cell; correlation of *in vitro* and *in vivo* experiments.

NUCLEAR ENGINEERING SCIENCES

GRADUATE FACULTY 1970-71

Ohanian, M. J., *Chairman;* Bullock, T. E.; Campbell, H. D.; Carroll, E. E.; Dalton, G. R.; Diaz, N. J.; Ellis, W. H.; Englehart, R. W.; Kylstra, C. D.; Mockel, A. J.; Rhines, F. N.; Schneider, R. T.; Schoessow, G. J.; Uhrig, R. E.; Wethington, J. A., Jr.

Graduate Coordinator: H. D. Campbell

The Department of Nuclear Engineering Sciences offers the degrees of Master of Science (with thesis), Master of Engineering (non-thesis), Engineer, and Doctor of Philosophy.

The requirement for admission to the graduate program in Nuclear Engineering Sciences is a bachelor's degree in an approved program in engineering or in the physical sciences. Approved programs normally include the following subjects: modern and nuclear physics, heat transfer or thermodynamics, fluid mechanics, introduction to nuclear engineering, vector analysis and introduction to complex variables. If the student's background is considered deficient for his planned course of study, an articulation program of background courses will be required.

In certain cases, depending on the student's professional objectives, he may omit the master's thesis and substitute 18 credits of graduate-level course work, of which at least 9 credits are in Nuclear Engineering Sciences, including a 6-credit (minimum) special project (NES 691). In such cases the completion of 54 credits of course work will meet the requirements for the Master of Engineering (non-thesis) degree, with major in Nuclear Engineering Sciences.

The following *Engineering Common Courses* are available for graduate major credit; EGC 508—Fundamentals of Radiation Protection; EGC 578—Nuclear Chemical Technology; EGC 671—Introduction to Plasmas; EGC

672—Plasma Theory; EGC 675—Plasma Laboratory; EGC 677—Gas Lasers and Their Engineering Applications.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

NES 500—Principles of Nuclear Reactors. 4 credits
NES 530—Applications of Nuclear Radiation and Energy 2. 4 credits
NES 535—Interaction of Radiation with Matter. 4 credits
NES 540—Nuclear Radiation Detection and Instrumentation. 4 credits
NES 551—Nuclear Power Reactors 1. 4 credits
NES 555—Reactor Fuel Cycles. 3 credits
NES 560—Nuclear Undersea Applications. 3 credits
NES 565—Nuclear Space Applications. 3 credits
NES 570—Principles of Nuclear Reactor Operations. 3 credits

GRADUATE COURSES

NES 600—Nuclear Engineering Laboratory 2. 4 credits
Prerequisites: NES 404, NES 540. Corequisite: NES 610. Laboratory practice in neutron and gamma detection and analysis. Determination of basic neutron parameters in nonmultiplying and multiplying media.

NES 601—Nuclear Engineering Laboratory 3. 4 credits
Continuation of NES 600. Laboratory practice in measurement of basic reactor parameters and the effects of reactor perturbation.

NES 610—Reactor Analysis 1. 3 credits
Prerequisites: NES 401, NES 402, NES 403. Neutron diffusion theory, homogeneous and one-velocity reactors. Time-dependent behavior of the neutron flux, reactor kinetics with temperature dependence.

NES 611—Reactor Analysis 2. 3 credits
Prerequisite: NES 610. Reactor analysis in terms of the slowing-down model and Fermi-age theory. Six-factor formula, reactor temperature coefficients, introduction to perturbation theory as applied to reactivity calculations.

NES 612—Advanced Reactor Analysis. 3 credits
Prerequisite: NES 611. Analytical methods of heterogeneous reactor calculations, fundamentals of control-rod theory, disadvantage factor, thermal utilization, resonance escape probability, fast fission; monoenergetic transport theory.

NES 614—Neutron Transport Theory. 3 credits
Prerequisite: NES 612. Neutron transport equation, approximations based on orthogonal functions, variational techniques, and Monte Carlo methods applied to monoenergetic and energy dependent transport theory.

NES 616—Numerical Methods of Reactor Analysis. 4 credits
Prerequisite: NES 610. Corequisite: NES 612. Numerical solutions to reactor analysis problems, emphasis on the solution of one-, two- and three-dimensional diffusion equations, multiregion and multigroup diffusion methods, P_N and S_N calculations.

NES 617—Computer Programs in the Nuclear Industry. 4 credits
Prerequisites: NES 610, ISE 351. Description and use of the most widely employed methods and codes used in reactor physics calculations by industry.

NES 618—Principles of Fast Reactors. 3 credits
Prerequisite: NES 612. Underlying mathematical techniques of fast reactor

physics. Quantum mechanical procedures for nuclear processes involved in a fast reactor. Inelastic neutron scattering and resonance reactions.

NES 619—Fast Reactor Analysis. 3 credits

Prerequisite: NES 618. Computation of sodium void, Doppler and temperature coefficients, and fast reactor breeding ratio. Problems of fast reactor breeding.

NES 632—Nuclear Processing and Separations. 4 credits

Chemical processing of fertile and fissile materials and irradiated fuels, changes in composition and reactivity during fuel irradiation, nuclear reactors and the chemical plants associated with them, waste disposal.

NES 633—Isotope Separation. 3 credits

Stable isotopes important for conventional nuclear reactors, isotopes important for fusion, methods for separating them.

NES 642—Hybrid Computational Techniques in Nuclear Engineering Sciences. 3 credits

Prerequisite: ISE 357. Use of analog and digital computers coupled together. High-speed information transfer and storage. Application to problems in nuclear engineering sciences.

NES 644—Nuclear Data Acquisition and Processing. 4 credits

Prerequisites: NES 404, NES 540. Acquisition and processing of data from nuclear detectors. Multi-input systems. Use of "on-line" digital computers for control of experiments. Special instrumentation techniques.

NES 651—Nuclear Power Reactors 2. 4 credits

Prerequisites: NES 551, NES 610. Nuclear reactors for power generation with emphasis on use of computer codes and an advanced set of problems.

NES 652—Reactor Technology 1. 4 credits

Prerequisite: NES 611. Theories of previous courses applied to analytical design and economics of an integrated fast reactor nuclear plant.

NES 653—Reactor Technology 2. 4 credits

Prerequisite: NES 652. Analysis of reactor systems by comparison of actual and predicted performance, with emphasis on use of computer codes.

NES 654—Special Nuclear Materials. 3 credits

Prerequisites: NES 402, NES 403. Special materials used in all types of reactors; changes in properties due to radiation corrosion and other deteriorating mechanisms.

NES 655—Fundamental Aspects of Reactor Shielding. 3 credits

Prerequisite: NES 611. Shielding design fundamentals. Methods of calculating gamma-ray attenuation, fast neutron penetration, effects of ducts and voids in shields, problems of heat generation and deposition in reactor components.

NES 660—Fundamentals of Reactor Kinetics. 4 credits

Prerequisite: NES 611. Dynamic behavior of nuclear reactor systems from the point of view of linear control theory. Laboratory use of analog computer to study reactor kinetics problems.

NES 661—Advanced Reactor Kinetics. 3 credits

Prerequisite: NES 660. Nuclear reactor dynamics, spatially dependent kinetics, techniques of nonlinear stability analysis, and kinetics of various reactor prototypes.

NES 662—Random Noise Techniques in Nuclear Systems. 3 credits

Random noise techniques and the evaluation of nuclear reactor parameters. Auto- and cross-correlation functions and power and cross spectral density analysis.

NES 670—Plasma Spectroscopy. 4 credits

Spectroscopic techniques for measurement of temperature and density of

plasmas, and their application to thermonuclear fusion and direct energy conversion devices.

NES 673—Advanced Plasma Theory. 4 credits

Prerequisite: NES 670. Fundamental equations of statistical plasma theory (Vlasov, Boltzmann, Fokker-Planck and radiation transport equations, their solution, and typical applications to plasmas).

NES 674—Thermonuclear Fusion. 3 credits

Foundations of thermonuclear reactions. Methods of heating plasmas to extreme temperatures; plasma containment by magnetic fields; plasma instabilities.

NES 678—Direct Energy Conversion. 4 credits

Various direct conversion systems with emphasis on systems involving nuclear reactors or nuclear reactions.

NES 690—Nuclear Seminar. 1 credit

May be repeated with change of content up to a maximum of 4 credits.

NES 691—Special Projects in Nuclear Engineering Sciences. 1 to 9 credits

Nonthesis research projects. May be repeated with change of content up to a maximum of 18 credits.

NES 692—Special Topics in Nuclear Engineering Sciences. 1 to 9 credits

May be repeated with change of content up to a maximum of 18 credits.

NES 694—Individual Work. 1 to 6 credits

Supervised study or research in areas not covered by other graduate courses. May be repeated with change of content up to a maximum of 18 credits.

NES 699—Master's Research. 1 to 17 credits

NES 799—Doctoral Research. 1 to 17 credits

NURSING

GRADUATE FACULTY 1970-71

Smith, D. M., *Dean;* Barton, P. H.; Dykes, E. E.; Hilliard, M. E.; Kimball, H. P.; Knowles, L. N.; Luther, D. L.; McKenna, M. E.; Moore, J. L.; Patray, J. H.; Remillet, J. G.; Snider, J.; Taylor, C. D.; Wilson, J. M.

Graduate Corrdinator: M. E. McKenna

In addition to the requirements of the Graduate School, prerequisite for admission to graduate study in nursing is a bachelor's degree in an approved program in nursing. The student is expected to have completed basic psychiatric nursing theory and experience and public health nursing theory and experience in some prior nursing program.

GRADUATE COURSES

NSG 602—Dimensions of the Nursing Profession. 4 credits

Historical development of nursing related to current issues and trends in nursing. Probable modifications of nursing roles in a dynamic and complex culture.

NSG 603—Seminar in General Nursing. 4 credits
Crisis theory with implications for nursing practice.

NSG 604—Roles and Relationships in the Contemporary American Hospital. 4 credits
Modifications of existing roles and the development of new roles as an adaptive response to change.

NSG 605—Health Care and the Life Cycle of the Family. 4 credits
The family from its inception to its dissolution, particularly during sickness, birth, and death.

NSG 606—Effective Participation in Group Activity. 4 credits
Analysis of and experiential approaches to the management of a wide range of group situations in which students are participant-observers.

NSG 607—The Contemporary American Hospital. 4 credits
The hospital as a dynamic and complex social system. Strategies that permit hospitals to function more productively.

NSG 608—The Analysis of Nursing Procedures. 4 credits
Technical procedures employed in nursing practice. Contributions made by scientific knowledge, tradition, cost, and work simplification techniques.

NSG 610—Seminar in Medical Surgical Nursing 1. 4 credits
Theories, principles, and concepts of the biological, physical, and social sciences needed in solving nursing problems of adult patients undergoing medical therapeutics or surgical intervention.

NSG 611—Seminar in Medical Surgical Nursing 2. 4 credits
Prerequisite: NSG 610. Continuation of NSG 610.

NSG 612—Clinical Practice in Medical Surgical Nursing. 4 credits
Prerequisites: NSG 610, NSG 611. Application of scientific principles and concepts to the care of adults undergoing medical therapeutics or surgical intervention.

NSG 613—Advanced Medical Surgical Nursing. 4 credits
Prerequisites: NSG 610, NSG 611. Nursing problems of adults undergoing medical therapeutics or surgical intervention.

NSG 620—Advanced Psychiatric and Mental Health Nursing. 4 credits
Application of normal developmental processes to psychiatric nursing.

NSG 621—Area Seminar in Clinical Psychiatric Nursing. 4 credits
Prerequisite: NSG 620. Psychiatric illnesses and concurrent clinical application of theory; the nursing process and its effect on abnormal behavior.

NSG 622—Advanced Psychiatric Nursing: Nursing Intervention in Mental Illness. 4 credits
Prerequisites: NSG 620, NSG 621. Psychotherapeutic approaches and processes; applicability of specific characteristics to psychotherapeutic nursing processes.

NSG 623—Clinical Problems in Psychiatric Nursing. 4 credits
Prerequisites: NSG 620, NSG 621, NSG 622. Case materials and clinical problems related to the psychiatric nursing situation as an aid to assessing and managing patients' nursing requirements.

NSG 630—Individual Study. 1 to 4 credits
Reading and/or research in areas of nursing needed by graduate students. May be repeated with change of content up to a maximum of 12 credits.

NSG 640—Pediatric Nursing: Problems of the Well Child. 4 credits
Seminar on growth and development and the implications for child health care. Development of skill in interviewing, observing, and appraising growth and development.

NSG 641—Seminar in Adolescent Health Care. 4 credits
Common health problems of the adolescent. Biological, sociocultural, and psychological factors in development of nursing care.

NSG 642—Pediatric Nursing: The Ill Child. 4 credits
Seminar and practice in converting laws derived from physical, biological, and social sciences into principles of nursing care of the ill child.

NSG 645—Seminar in Nursing Care of the Mentally Retarded Child. 4 credits
Role of the nurse as a member of the multi-disciplinary team in prevention and case finding of mental retardation and in follow-up care in the home and the institution.

NSG 650—Seminar in Maternal and Infant Health. 4 credits
The literature of the biological, physical, behavioral, and medical sciences which supports nursing practice relating to the reproductive function and infant care.

NSG 651—Maternity Nursing Practices: Prenatal Period. 4 credits
Scientifically based nursing care of expectant mothers during the prenatal period, utilizing selected patient experiences for intensive study.

NSG 652—Maternal and Infant Health Practice: Hospitalization Period. 4 credits
Scientifically based nursing care of mothers and infants during hospitalization period, utilizing selected patient experiences for intensive study.

NSG 653—Maternal-Infant Practices: Community Care. 4 credits
Nursing care to meet the needs of mothers and infants in a community setting.

NSG 660—Research Methods in Nursing. 4 credits
Research methods and their application to nursing; published studies in nursing and the utility of findings.

NSG 671—Practicum in Nursing. 4 to 12 credits
Individually planned experiences related to the functional goals of the student. May be taken for two quarters only. May be repeated with change of content up to a maximum of 12 credits.

NSG 672—Internship in Nursing Team Leadership. 4 credits
Supervised work experience in the role and functions of team leadership. Designed as a sequence of two or three quarters which must include a minimum of 880-1320 work hours. May be repeated with change of content up to a maximum of 8 credits.

NSG 680—New Dimensions in Health in the Community. 4 credits
Seminar on health as a community affair; governmental levels of legislation that have created new directions to guide personnel in public health.

NSG 690—Residency. 4 to 12 credits
Prerequisites: Master's degree in nursing; admission to residency program. Supervised experience in approved settings. Designed as a sequence of 3 quarters. Reading assignments, individual and group conferences. May be repeated with change of content up to a maximum of 12 credits.

NSG 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

NSG 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

ORNAMENTAL HORTICULTURE

GRADUATE FACULTY 1970-71

STROEBEL, J. W., *Chairman;* DICKEY, R. D.; HORN, G. C.; JOINER, J. N.; MCELWEE, E. W.; SHEEHAN, T. J.; WHITCOMB, C. E.

Graduate Coordinator: J. N. JOINER

Graduate majors in ornamental horticulture should have 24 undergraduate credits in horticulture or ornamental horticulture. The student is advised to have completed 30 credits in basic courses in botany, chemistry, soils, entomology, plant pathology, and related subjects.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

OH 511—ORCHIDOLOGY. 4 credits

GRADUATE COURSES

OH 603—GRADUATE SEMINAR. 1 credit
Reading, reports, and discussion of current literature on ornamental horticultural research topics and development. Means of communication as an aid in understanding and evaluating technical information.

OH 612—NUTRITION OF ORNAMENTAL PLANTS. 5 credits
Prerequisites: BTY 310, OH 441. Physiological, biochemical, and environmental factors influencing nutritional status of horticultural plants and the resulting effects on growth, yield, and quality.

OH 620—NURSERY PRODUCTION AND MANAGEMENT. 4 credits
Prerequisites: BTY 310, PLS 301, OH 420. Literature review and application of research results to problems of commercial production of woody ornamental plants.

OH 630—RESEARCH METHODS IN ORNAMENTAL HORTICULTURE. 4 credits
Research methods, procedures, and literature reviewed with applications to ornamental plants. Outlining of problems, assembly and analysis of data, and presentation of results.

OH 641—FLORICULTURAL SCIENCE. 4 credits
Prerequisite: OH 442 or OH 443. Physiological and biochemical factors affecting growth and yield of floricultural crops; use and effects of growth regulating compounds and herbicides; techniques of breeding these crops; post-harvest physiology, storage and marketing problems.

OH 662—RESEARCH AND DEVELOPMENT IN TURFGRASS TECHNOLOGY. 4 credits
Prerequisite: OH 463. Principles and practices of turfgrass improvement and management, including propagation, nutrition, physiology, soil management, and experimental methods applied to turf research.

OH 670—NON-THESIS RESEARCH IN ORNAMENTAL HORTICULTURE. 1 to 9 credits

OH 697—SUPERVISED RESEARCH. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

OH 698—SUPERVISED TEACHING. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

OH 699—MASTER'S RESEARCH. 1 to 17 credits

PATHOLOGY

GRADUATE FACULTY 1970-71

SMITH, R. T., *Chairman;* ADAMS, W. R.; COLLINS, G. H.; CRANDALL, C. A.; GEBARDT, B.; GLASSMAN, A.; HACKETT, R. L.; KLEIN, P. A.; NORMANN, S. J.; SAVORY, J.; SHAW, L. L.; TEAGUE, P. O.; WOODARD, J. C.

Graduate Coordinator: P. A. KLEIN

Prerequisites: Students entering this program will be required to have the following undergraduate courses: general chemistry, organic chemistry, general physics, general biology, and two or more advanced courses in the area of physiological, developmental or cellular biology, or, in the case of students in clinical chemistry, courses in analytical, inorganic, and physical chemistry. Students may find it necessary to remedy deficiencies in their background by taking some undergraduate courses after admission to the Graduate School.

Courses in the major program will be determined by the graduate student's advisory committee. The minor may be taken in any appropriate area.

Thesis: Satisfactory completion of a thesis based on research is a requirement for a graduate degree.

GRADUATE COURSES

MED 610—MECHANISMS OF DISEASE. 5 credits
General principles of pathology and the mechanisms responsible for disease processes. May be taken by advanced undergraduates with consent of staff.

MED 611—SYSTEMIC PATHOLOGY. 6 credits
Prerequisites: MED 610 and consent of staff. Pathological processes affecting each organ or organ system.

MED 640—CLINICAL CHEMISTRY AND TOXICOLOGY. 3 credits
Chemical techniques undertaken for the diagnosis of disease. Methods of toxicology.

MED 641—SPECIAL CYTOLOGY. 5 credits
Types of cells such as nerve, secretory, bone, muscle, connective tissue, blood, and lymphoid.

MED 642—IMMUNOHEMATOLOGY. 3 credits
Immunologic, genetic, and anthropologic significance of blood group antigens and antibodies with emphasis on their serologic and immunochemical characteristics.

MED 643—CLINICAL CHEMISTRY AND TOXICOLOGY ROTATION 1. 10 credits
Participation in all phases of practical clinical chemistry and toxicology. Chemical methodology, clinical interpretation, and significance of laboratory measurements for the diagnosis of the sick. Individual investigative project in clinical chemistry and toxicology. Students specializing in clinical chemistry must spend three terms on this rotation.

MED 644—CLINICAL CHEMISTRY AND TOXICOLOGY ROTATION 2. 10 credits
Prerequisite: MED 643. Continuation of MED 643.

MED 645—CLINICAL CHEMISTRY AND TOXICOLOGY ROTATION 3. 10 credits
Prerequisite: MED 644. Continuation of MED 644.

MED 646—SPECIAL TOPICS IN PATHOLOGY. 1 to 6 credits

Prerequisite: Permission of department. Supervised conferences and laboratory work. Topics selected to meet each student's needs. May be repeated with change of content up to a maximum of 18 credits.

MED 647—Seminar in Pathology. 1 credit

Required of graduate students in pathology; open to others by permission of the department. Current research literature and research reports by graduate students, department staff, and invited speakers.

MED 648—Comparative Pathology. 4 credits

Prerequisites: MED 561, MED 511. The diseases of various organ systems of domestic and laboratory animals compared and contrasted with spontaneous diseases of man.

MED 649—Nutritional and Biochemical Pathology. 4 credits

Prerequisites: MED 561, MED 511. The relationships between biochemical alterations and microscopic lesions in spontaneous and experimentally induced diseases having a defined nutritional or biochemical etiology.

MED 690—Tumor Biology. 4 credits

Pathobiology, biochemistry, and molecular biology of neoplasia; viral and chemical carcinogenesis; immunology and therapy of cancer in man and animals.

MED 691—Immunopathology. 3 credits

Abnormalities and diseases with immunological basis or component. Clinical and experimental specimens for analysis by modern immunological techniques.

MED 692—Experimental Tumor Biology. 3 credits

Prerequisite: MED 690 or consent of staff. The development of laboratory skills and fundamental techniques in the study of various phenomena in tumor biology. Students will work in direct association with members of the MED 690 staff.

MED 693—Immunobiology. 5 credits

Biological aspects of the defense systems, specific and nonspecific, cellular and humoral, amplification systems involving immune interactions; normal and abnormal conditions and sequellae, pathologic aspects of immunologic phenomena; phylogenetic and developmental aspects of immunity.

MED 694—Immunobiology Laboratory. 3 credits

Prerequisite: Consent of staff. Corequisite: MED 693. Project oriented. Laboratory skills and techniques in immunobiology. Each student or small group of students will work in close association with a faculty member.

PHARMACEUTICAL CHEMISTRY

The program in Pharmaceutical Chemistry is conducted by the faculty of Pharmacy (*q.v.*).

GRADUATE COURSES

PCY 611—Synthetic Medicinal Products 1. 3 credits

Preparation of the more complex synthetic medicinals. The relationship between chemical constitution and physiological action.

PCY 612—Synthetic Medicinal Products 2. 3 credits

Continuation of PCY 611.

PCY 613—Synthetic Medicinal Products 1. 3 credits

Accompanying laboratory course for PCY 611. Synthesis of organic medicinal compounds.

PCY 614—Synthetic Medicinal Products 2. 3 credits
Accompanying laboratory course for PCY 612. Synthesis of organic medicinal compounds.

PCY 615—Synthetic Medicinal Products 3. 3 credits
Continuation of PCY 612.

PCY 621—Natural Medicinal Products 1. 3 credits
Chemistry of compounds derived from plants and animals.

PCY 622—Natural Medicinal Products 2. 3 credits
Continuation of PCY 621.

PCY 623—Natural Medicinal Products 1. 3 credits
Accompanying laboratory course for PCY 621. Isolation and identification of plant and animal products.

PCY 624—Natural Medicinal Products 2. 3 credits
Accompanying laboratory course for PCY 622. Isolation and identification of plant and animal products.

PCY 625—Natural Medicinal Products 3. 3 credits
Continuation of PCY 622.

PCY 631—Analytical and Control Methods 1. 5 credits
Analytical and control methods, with emphasis on the more complicated procedures of the U.S.P., N.F., A.O.A.C. and recent literature.

PCY 632—Analytical and Control Methods 2. 5 credits
Continuation of PCY 631.

PCY 633—Analytical and Control Methods 3. 5 credits
Continuation of PCY 632.

PCY 642—Chemobiodynamics. 5 credits
Prerequisite: PCY 611. Theoretical treatment of structure-activity relationships and approaches to drug design.

PCY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PCY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PCY 699—Master's Research. 1 to 17 credits

PCY 799—Doctoral Research. 1 to 17 credits

PHARMACOGNOSY

The program in Pharmacognosy is conducted by the faculty of Pharmacy (*q.v.*).

GRADUATE COURSES

PGY 601—Advanced Histology and Microscopy of Vegetable Drugs. 5 credits
Advanced microscopic structure and identification.

PGY 603—Microanalytical Pharmacognosy. 2 credits
Micro methods for plant constituents.

PGY 604—Cultivation and Processing of Medicinal Plants. 3 credits
Commercial sources, culture, and preparation of botanical drugs.

PGY 625—Drug Plant Analysis. 2 to 4 credits
Chemical constituents and their identification and determination in drug plants.

PGY 626—Drug Plant Analysis. 2 to 4 credits
Continuation of PGY 625.

PGY 627—Drug Plant Analysis. 2 to 4 credits
Continuation of PGY 626.

PGY 699—Master's Research. 1 to 17 credits

PGY 799—Doctoral Research. 1 to 17 credits

PHARMACOLOGY

GRADUATE FACULTY 1970-71

Maren, T. H., *Chairman;* Chiou, C. Y.; Cramer, J. W.; Fox, L. E.; Leibman, K. C.; Oppelt, W. W.; Weinstein, I.

Graduate Coordinator: K. C. Leibman

Students entering the course of study for the degree of Ph.D. in Medical Sciences with major in pharmacology should present undergraduate course credits in chemistry, including quantitative, analytical, organic, and physical chemistry; elementary physics and biology, and mathematics through the calculus. Otherwise well-qualified students with certain deficiencies in preparation may be allowed to make these up during the first year of graduate study. In addition to elementary and advanced study in pharmacology, candidates will pursue courses in biochemistry, physiology, and other medical sciences as determined by consultation with their advisory committees.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

MED 566—Advanced Medical Pharmacology. 6 credits

GRADUATE COURSES

MED 670—Introduction to Pharmacology. 5 credits
Prerequisites: Elementary courses in biochemistry and physiology. Overview of the entire field of pharmacology as the study of the interactions between living systems and foreign chemicals. Intended to prepare majors for advanced courses or to familiarize nonmajors with the area.

MED 671—Theoretical Pharmacology. 5 credits
Prerequisites: MED 670, CY 342. Physical, physicochemical, and mathematical aspects of pharmacology, including the theory of drug-receptor complexes, transport and distribution kinetics and equilibria, and the kinetics of enzyme inhibition by drugs.

MED 672—Chemical Pharmacology. 5 credits
Prerequisite: MED 670. Chemical aspects of several areas of modern pharmacology, such as metabolism of foreign compounds, structure-activity relationships, the biochemistry of drug activity.

MED 673—Recent Advances in Pharmacology. 5 credits
Prerequisite: MED 670.

MED 674—Seminar in Pharmacology. 1 credit

Prerequisite: MED 670. Research reports and discussions of current research literature by graduate students, faculty, and invited lecturers.

MED 701—Research Methods in Pharmacology 1. 1 credit

Readings, discussions, and practical experience with modern research methods used in pharmacology. Both instrumental and biological methods.

MED 702—Research Methods in Pharmacology 2. 1 credit

Continuation of MED 701.

MED 703—Topics in Pharmacology. 0 to 4 credits

Seminars, informal conferences, or laboratory work on the use of drugs in biochemical and physiological investigations. May be repeated with change of content up to a maximum of 12 credits.

PHARMACY

GRADUATE FACULTY 1970-71

Blythe, R. H., *Chairman*; Araujo, O. E.; Becker, C. H.; Finger, K. F.; Garrett, E. R.; Gramling, L. G.; Hammer, R. H.; Johnson, C. H.; Lantos, R. L.; Rao, K. V.; Torosian, G.; Vilallonga, F. A.

Graduate Coordinator: F. A. Vilallonga

Prerequisite: A Bachelor of Science degree wtih a major in pharmacy, physical sciences, or biological sciences is required for admission to the Doctor of Philosophy program. Applicants should present standard undergraduate sequenses in chemistry, including qualitative, quantitative, organic, and physical; one year of physics; and mathematics through the calculus. Any deficiencies must be made up immediately after entering Graduate School.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

PHY 566—Dermatological Protectives. 5 credits

GRADUATE COURSES

PHY 601—Hospital Pharmacy Administration. 3 credits

Prerequisite: PHY 522 or classification as hospital pharmacy resident. Development, functions, responsibilities, organization, and administration of the hospital and the hospital pharmacy department. Viewpoint of the administrative responsibilities of the hospital pharmacist.

PHY 602—Selected Topics in Pharmacy. 3 credits

PHY 603—Research Methods in Pharmaceutical Sciences. 2 to 6 credits

Prerequisites: MS 302, CY 451. Pharmaceutical research in which the student acquires proficiency in research techniques and instrumentation used in physical pharmacy, drug stability, kinetics and pharmacokinetics, under supervision of a staff member.

PHY 604—Equilibria, Complexations, and Interactions of Drugs. 5 credits

Prerequisites: CY 453; MS 304 or MS 501. Models for drug interactions in solution. Physical chemical characteristics of drugs and their complexes in pharmaceutical systems.

PHY 605—Stability and Kinetics of Drugs. 5 credits

Prerequisites: CY 644, CY 662, STA 521, PHY 604. Kinetics, mechanisms and prediction of stability of *in vitro* transformations of drugs, including alkaloids, vitamins, steroids, salicylates, and their pharmaceutical formulations; application of analog computer.

PHY 606—Pharmacokinetics and Biopharmaceutics. 5 credits

Prerequisites: PHY 605 and a course in pharmacology, or by special arrangement. *In vivo* transformations of drugs and compartmental analysis with analog computer; absorption, transfer, protein binding, metabolism, excretion, receptor site interaction, and biological availability from the dosage form.

PHY 607—Advanced Topics in Pharmaceutical Sciences. 1 to 2 credits

Oral reports on the pharmaceutical sciences; discussion and critical review of such topics; written and oral presentations of research designs, protocols, papers, and critical appraisals.

PHY 611—Hospital Pharmacy Seminar. 1 credit

Prerequisite: Classification as hospital pharmacy resident. Master's candidates specializing in hospital pharmacy must register for this course each quarter but not more than 3 credits are allowed. Oral reports related to hospital pharmacy. Discussion of problems.

PHY 643—Pharmaceutical Equipment and Machinery. 4 credits

Industrial pharmaceutical machinery and equipment such as colloid mills and homogenizers, sifters, pulverizers, centrifuges, tablet machines and ampul washers, fillers and sealers. Manufacture of pharmaceutical products on a pilot-plant scale in the laboratory.

PHY 645—Pharmaceutical Machinery and Product Formulation. 4 credits

Continuation of PHY 643 with rationale and design of some pharmaceutical dosage forms, particularly on inherent physical and chemical problems, stability and biopharmacy. Selected formulas prepared for evaluation on a laboratory and pilot-plant scale.

PHY 647—Pharmaceutical Product Formulation. 4 credits

Continuation of PHY 645. Rationale and design of some pharmaceutical dosage forms, such as inherent physical and chemical problems, stability and biopharmacy. Selected formulas prepared for evaluation on a laboratory and pilot-plant scale.

PHY 653—Parenterals. 5 credits

Techniques of preparation, administration, and testing of materials designed for parenteral injection.

PHY 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

PHY 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

PHY 699—Master's Research. 1 to 17 credits

PHY 799—Doctoral Research. 1 to 17 credits

PHILOSOPHY

GRADUATE FACULTY 1970-71

Hanna, T. L., *Chairman;* Allison, H. A.; Bartlett, G. R.; Haynes, R. P.; Jones, W. B.; Lewis, A.; Megill, K. A.; Mehlberg, H.; Millikan, J. D.; Morris, C. W.; Wartenberg, G.; Zeman, J. J.; Zweig, M. B.

Graduate Coordinator: R. P. Haynes

Students planning work in philosophy leading to the master's degree are advised to consult the chairman of the department at their earliest opportunity.

Prerequisites: Adequate undergraduate preparation in philosophy. The consent of the chairman of the department is required before students will be enrolled in any graduate course.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

PPY 509—Special Topics. 1 to 5 credits
PPY 511—Studies in Ancient Philosophy. 5 credits
PPY 512—Studies in Medieval Philosophy. 5 credits
PPY 513—Studies in Modern Philosophy. 5 credits
PPY 514—Studies in 19th and 20th Century Philosophy. 5 credits
PPY 518—The Pragmatic Movement. 5 credits
PPY 520—Semantics. 5 credits
PPY 522—Studies in Philosophy of Science. 5 credits
PPY 523—Studies in Philosophy of Mathematics. 5 credits
PPY 530—Advanced Symbolic Logic. 5 credits
PPY 535—Computability and Unsolvability. 5 credits
PPY 541—Studies in Theory of Knowledge. 5 credits
PPY 542—Metaphysics. 5 credits
PPY 544—Studies in Phenomenology. 5 credits
PPY 546—Studies in Analytic Philosophy. 5 credits
PPY 561—Studies in Social-Political Philosophy. 5 credits
PPY 562—Studies in Theory of Value. 5 credits
PPY 570—Studies in the Philosophy of Art. 5 credits
PPY 580—Studies in the Philosophy of Religion. 5 credits
PPY 590—Individual Work. 1 to 5 credits
PPY 595—Honors Seminar. 3 to 5 credits

GRADUATE COURSES

PPY 609—Special Topics. 1 to 5 credits
PPY 611—Seminar in Ancient Philosophy. 5 credits
PPY 612—Seminar in Medieval Philosophy. 5 credits
PPY 613—Seminar in Modern Philosophy. 5 credits
May be repeated with change of content up to a maximum of 15 credits.
PPY 614—Seminar in 19th and 20th Century Philosophy. 5 credits
Devoted to a study of one major thinker from the period. May be repeated with change of content up to a maximum of 15 credits.
PPY 630—Seminar in Logic. 5 credits
May be repeated with change of content up to a maximum of 15 credits.
PPY 638—Logical Empiricism. 5 credits
PPY 641—Seminar in Problems of Knowledge. 5 credits
PPY 642—Seminar in Metaphysics. 5 credits
PPY 643—Seminar in the Philosophy of Mind. 5 credits
PPY 644—Seminar in Phenomenology. 5 credits

Phenomenology as a philosophical method: Husserl, Sartre, Merleau-Ponty, Heidegger and others. Application of the method in exploration and interpretation of concrete experience.

PPY 646—SEMINAR IN ANALYTIC PHILOSOPHY. 5 credits
Prerequisite: PPY 326, PPY 546, or consent of instructor. Analytic philosophy as a tool in dealing with vital present-day philosophical, legal, and scientific issues.

PPY 661—SEMINAR IN SOCIAL-POLITICAL PHILOSOPHY. 5 credits

PPY 662—SEMINAR IN PROBLEMS OF VALUE. 5 credits

PPY 670—SEMINAR IN THE PHILOSOPHY OF ART. 5 credits

PPY 680—SEMINAR IN THE PHILOSOPHY OF RELIGION. 5 credits
May be repeated with change of content up to a maximum of 15 credits.

PPY 690—INDIVIDUAL WORK. 1 to 5 credits

PPY 697—SUPERVISED RESEARCH. 1 to 5 credits

PPY 698—SUPERVISED TEACHING. 1 to 5 credits

PPY 699—MASTER'S RESEARCH. 1 to 17 credits

PHYSICAL EDUCATION, HEALTH, AND RECREATION

GRADUATE FACULTY 1970-71

SANDEFUR, W. T., *Chairman;* ALEXANDER, R. H.; BOYD, C. A.; HICKS, D. A.; HOLYOAK, O. J.; KAUFMANN, D. A.; LEAVITT, N. M.; LERCH, H. A.; SMITH, B. C.; STANLEY, D. K.; STEVENS, B. K.; WAGLOW, I. F.; ZAUNER, C. W.

Graduate Coordinator: B. K. STEVENS

Graduate study is offered in both Physical Education and Health Education leading to Master of Physical Education, Master of Health Education, Master of Arts in Physical Education, and Master of Arts in Health Education degrees. The two Master of Arts degrees require theses. Students who have not met Florida teaching certification requirements in the area of their graduate major will be required to do so as a part of or in addition to the work for their respective master's degrees.

GRADUATE COURSES

PHR 601—INTERPRETATIONS OF PHYSICAL EDUCATION. 3 credits
Biological, psychological, sociological, and educational implications needed to interpret the function of physical education in contemporary democratic society.

PHR 603—NATURE AND BASES OF MOTOR PERFORMANCE. 5 credits
Principles relating to the development of motor skill, emphasizing conditions affecting its development and retention in physical education activities.

PHR 605—RESEARCH METHODS IN PHYSICAL EDUCATION, HEALTH EDUCATION, RECREATION. 5 credits

PHR 606—INDIVIDUAL WORK. 1 to 5 credits
Prerequisite: PHR 605. Individual research projects under faculty guidance.

PHR 607—SEMINAR IN PHYSICAL EDUCATION. 2 credits
Research implications for the field of physical education. May be repeated with change of content up to a maximum of 4 credits.

PHR 610—Evaluation Procedures in Physical Education and Health Education. 3 credits
Measurement and evaluation as applied to physical education and health education.

PHR 612—Physiological Bases of Physical Education. 5 credits
Application of fundamental concepts of human physiology to programs of physical education and sports. Recent research developments in sports physiology.

PHR 613—Practicum in Exercise Physiology. 3 credits
Prerequisite: PHR 612. Applied and experimental work emphasizing practical problems.

PHR 616—The Physical Education Curriculum. 5 credits
Principles and practices of developing an integrated physical education curriculum in grades 1 to 12.

PHR 618—The College Physical Education Program. 5 credits
Philosophy, program content, administration, and methods of conducting the required, intramural, and professional preparation programs of physical education in colleges and universities.

PHR 620—Problems in the Administration of Athletics. 5 credits
Interscholastic athletic program; place of athletics in education, program organization and administration, budget, equipment, facilities, intramurals, public relations, and legal liability.

PHR 633—Problems in Physical Education. 5 credits
Prerequisite: PHR 605. Emphasizes research developments.

PHR 645—Workshop Series. 1 to 10 credits
Special problems in physical education or health education.

PHR 660—Organizations and Practices in Programs of School and Public Health. 5 credits
Community development of the broad spectrum of health programs and services for the total community, including organization and operation, cooperative planning, and interagency coordination.

PHR 661—Scientific Foundations of Health. 5 credits
Prerequisites: PHR 261, PHR 262. Independent study and investigation of current problems and advances in health sciences applied to personal and community health.

PHR 662—Health Education Programs and Processes in School and Public Health. 5 credits
Nature and role of health education in changing health behavior, with emphasis on development of educational programs compatible with stated purposes, target groups, and appropriate settings.

PHR 663—Trends and Issues in Health Education. 5 credits
Educational approaches to health, with emphasis on controversial topics. Physical, social, economic, and legal aspects of problem causes, prevalence, and control.

PHR 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PHR 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PHR 699—Master's Research. 1 to 17 credits

PHYSICS

GRADUATE FACULTY 1970-71

BALLARD, S. S., *Chairman;* ADAMS, E. D.; ALLEN, K. R.; BAILEY, T. L.; BLUE, R. A.; BROYLES, A. A.; CARR, T. D.; CONKLIN, J. B., JR.; CONNOLLY, J. W. D.; DUNNAM, F. E.; FLOWERS, J. W.; GREEN, A. E. S.; HOOPER, C. F., JR.; ISLER, R. C.; LEBO, G. R.; LÖWDIN, P. O.; MICHA, D. A.; MUGA, M. L.; OMER, G. C., JR.; PARKINSON, M. T.; PETERSON, L. R.; PRASAD, S. S.; ROSENSHEIN, J. S.; SCOTT, T. A;. SLATER, J. C.; SMITH, A. G.; SWANSON, D. C.; THOMAS, B. S.; TRICKEY, S. B.; VAN RINSVELT, H. A.; WELLER, H. R.; WILLIAMS, D. T.

Graduate Coordinator: C. F. HOOPER, JR.

An undergraduate major in physics, or its equivalent, is prerequisite to undertaking a graduate program in physics. For the Master of Science degree, the student must have passed two academic years or the equivalent of a college-level foreign language (ordinarily French or German or Russian, but another language may be approved by his Supervisory Committee), or he must attain a score at or above the national 35th percentile on an approved ETS foreign language examination.

Some students will elect to complete the work for the Master of Science degree before continuing work for the Doctor of Philosophy, while others will work directly for the latter degree.

A reading knowledge of one of the three languages named above, as evidenced by a score at or above the 50th percentile on an approved ETS foreign language examination, or a functional knowledge of one of them, is required of the candidate for the degree of Doctor of Philosophy.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

PS 500—INTERMEDIATE DYNAMICS.	3 credits
PS 510—ELECTRIC AND MAGNETIC FIELDS.	3 credits
PS 515—ELECTRONICS 1.	3 credits
PS 516—ELECTRONICS 2.	3 credits
PS 520—FUNDAMENTALS OF STATISTICAL PHYSICS 2.	3 credits
PS 530—CLASSICAL AND MODERN OPTICS.	4 credits
PS 541—MODERN PHYSICS 3.	3 credits
PS 542—OPTICAL SPECTRA.	3 credits
PS 550—INTRODUCTORY SOLID STATE PHYSICS.	3 credits
PS 560—NUCLEAR PHYSICS.	3 credits
PS 566—LABORATORY TECHNIQUES IN NUCLEAR PHYSICS 2.	2 credits
PS 570—INTRODUCTION TO PARTICLE PHYSICS.	3 credits
PS 590—INDIVIDUAL WORK.	3 to 5 credits

GRADUATE COURSES

PS 601—CLASSICAL MECHANICS. 3 credits

Review of Lagrangian mechanics; special relativity, Hamiltonian mechanics,

canonical transformations, Hamilton-Jacobi theory, action angle variables, the mechanics of continuous media.

PS 605—Special Relativity. 3 credits
Introduction to Einstein's theory of special relativity, employing tensor analysis; general invariance and the background of the general theory of relativity.

PS 606—General Relativity. 2 credits
Einstein's general theory of relativity and relativistic cosmology.

PS 611—Electromagnetic Theory 1. 3 credits
Electrostatics, magnetostatics, and Maxwell's equations.

PS 612—Electromagnetic Theory 2. 3 credits
Prerequisite: PS 611. Diffraction, radiation theory, covariant formulation of electromagnetic theory.

PS 621—Statistical Mechanics. 3 credits
Prerequisites: PS 601, PS 644. B-B-G-K-Y hierarchy, Boltzmann equation, Euler's equations, ensemble theory, imperfect gases, density matrix, Slater sum, ideal quantum gases.

PS 629—Chemical Physics. 3 credits
Identical with CY 629. Interatomic and intermolecular forces. Binding energy, optical, electrical, and magnetic properties of crystals.

PS 633—Radiopropagation and Ionospheric Physics 1. 3 credits
Identical with ATY 633. Prerequisite: PS 410. Propagation of electromagnetic waves in a magneto-ionic medium; scattering from density fluctuations; whistlers; models of neutral atmosphere; neutral winds; atomic, molecular, and plasma properties of ionospheric interest.

PS 634—Radiopropagation and Ionospheric Physics 2. 3 credits
Identical with ATY 634. Prerequisite: PS 633. Ionospheric electron density and ion composition profiles; diurnal, seasonal, and global variations; pre-sunrise effects; electron and ion temperatures; traveling disturbances; solar flare and magnetic storm effects.

PS 636—Atomic Physics of Planetary Atmospheres. 3 credits
Identical with ATY 636. Prerequisites: Basic physics course and mathematics courses through integral calculus. Atomic and quantum theory, quantum mechanics and the central field problem, atomic and molecular spectroscopy, collisional cross sections for aeronomy.

PS 637—Physics of the Earth's Upper Atmosphere. 3 credits
Identical with ATY 637. Prerequisite: PS 636. Solar-terrestrial relations, aurora, airglow, and ionospheric phenomena. Remote sensing of atmospheric emissions and scattered solar radiation.

PS 638—Physics of Planetary Atmospheres. 3 credits
Identical with ATY 638. Prerequisite: PS 637. Radiative transfer in Planetary Atmospheres, from the x-ray to radio regions. Discussion of recent studies of the atmospheres of Venus, Mars, Jupiter, and other planets.

PS 642—Theory of Optical Spectra. 3 credits
Prerequisite: PS 645. Theory of angular momentum applied to the structure and spectra of atoms.

PS 643—Quantum Mechanics 1. 3 credits
Prerequisites: MS 501, MS 502, PS 541. The Schrödinger equation. WKB approximation, properties of operators and eigenfunctions, matrices, angular momentum, hydrogen atom.

PS 644—Quantum Mechanics 2. 3 credits
Prerequisite: PS 643. Variational principle, elementary perturbation theory, degenerate perturbation theory. Dirac notation and spin. Quantum theory of measurement.

PS 645—Quantum Mechanics 3. 3 credits
Prerequisite: PS 644. Scattering theory, identical particles, quantized amplitudes, positron hole theory, addition of angular momentum, symmetry principles. Topics may be shifted among PS 643, PS 644 and PS 645.

PS 647—Quantum Theory of Matter 1. 4 credits
Identical with CY 647. Prerequisites: PS 440, MS 501, MS 502, MS 503. Schrödinger's equation, matrix methods, variation, and perturbation theory. The hydrogen atom, the self-consistent field. Angular momentum, the vector model of the atom.

PS 648—Quantum Theory of Matter 2. 4 credits
Identical with CY 648. Prerequisite: PS 647. The determinantal method and multiplets. Interaction of radiation and matter. Spinning electron. Thomas-Fermi and Hartree-Fock methods. The hydrogen molecular ion and molecule.

PS 649—Quantum Theory of Matter 3. 4 credits
Identical with CY 649. Prerequisite: PS 648. Diatomic and polyatomic molecules. Group theory and symmetry of molecules. Energy bands in crystals.

PS 660—Seminar in Experimental Nuclear Physics. 1 credit
Current literature of nuclear-structure physics from an experimental viewpoint. May be repeated with change of content up to a maximum of 20 credits.

PS 661—Theoretical Foundations of Nuclear Physics. 3 credits
Schrödinger's equation and the independent particle model of the nucleus, velocity dependent potentials, relations of IPM to resonances, doorway states, direct reactions, the N-N interaction, and nuclear structure.

PS 662—Experimental Foundations of Nuclear Physics 1. 3 credits
Prerequisite: PS 661. Radioactivity, radiation detection, nuclear decay, accelerators, basic nuclear reaction studies. Nuclear spectroscopy.

PS 663—Experimental Foundations of Nuclear Physics 2. 3 credits
Prerequisite: PS 662. Nuclear structure, with emphasis on information obtained through nuclear reactions. Application of experimental results to various nuclear models. Scattering.

PS 671—Relativistic Quantum Mechanics. 3 credits
Prerequisite: PS 645. The inhomogeneous Lorentz group. One-particle relativistic wave equations for spins 0, ½, and 1 and their Green's functions (Feynman propagators). Photon-electron interaction and Feynman diagrams.

PS 672—Quantum Electrodynamics. 3 credits
Prerequisite: PS 671. Renormalization, the Bethe-Salpeter equation, the hydrogen atom, natural line breadth, and the Compton effect.

PS 680—Seminar in Modern Physics. 1 credit
Recent developments in theoretical and experimental physics. May be repeated with change of content up to a maximum of 20 credits.

PS 681—Computer Methods in Physics. 3 credits
Prerequisite: PS 541, an elementary knowledge of Fortran programming. Numerical techniques useful in solving physical problems. Aspects of advanced Fortran programming. Use of the computer.

PS 682—Low-Temperature Physics. 3 credits
Prerequisites: PS 644, PS 648. Techniques and problems of low-temperature

physics; production and measurement of low temperatures; properties of liquid helium, superconductivity, paramagnetism, magnetic cooling, thermodynamic aspects.

PS 690—Individual Work. 3 to 5 credits
Assigned reading program or development of an assigned experimental problem. Work selected to meet needs and interests of the student. May be repeated with change of content up to a maximum of 18 credits.

PS 696—Departmental Seminar. 1 credit
Physics, astrophysics, and astronomy topics presented by local staff members and visiting scientists. May be repeated for credit.

PS 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PS 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PS 699—Master's Research. 1 to 17 credits

PS 703—Advanced Classical Mechanics. 3 credits
Prerequisite: PS 601. Rigid rotators; elasticity; vibrations, normal modes, waves.

PS 713—Advanced Electromagnetic Theory. 3 credits
Prerequisite: PS 612. Special topics. Content varies, but may include radiation reaction, Lienard-Wiechert potentials, Cerenkov effect, nonlinear optics.

PS 722—Advanced Statistical Mechanics 1. 3 credits
Prerequisite: PS 621. Irreversible processes, many-body problem, Ising model, cluster expansions, phase transitions.

PS 723—Advanced Statistical Mechanics 2. 3 credits
Prerequisite: PS 722. Continuation of PS 722.

PS 741—Atomic and Molecular Collisions 1. 3 credits
Prerequisite: PS 645. Classical and quantum theories of collisions of atoms and molecules, with emphasis on low-energy collisions. Approximate theoretical methods and recent experimental developments.

PS 742—Atomic and Molecular Collisions 2. 3 credits
Prerequisite: PS 741. Continuation of PS 741.

PS 753—Physics of the Solid State 1. 3 credits
Prerequisites: PS 621, PS 648, PS 644. Band theory of solids. The Fermi surface.

PS 754—Physics of the Solid State 2. 3 credits
Prerequisite: PS 753. Transport properties and optical properties of solids.

PS 755—Physics of the Solid State 3. 3 credits
Prerequisite: PS 754. Magnetism.

PS 756—Theory of Atomic and Molecular Structure 1. 3 credits
Identical with CY 756. Prerequisite: PS 649. Mathematical techniques used in atomic, molecular, and solid-state theory. The one-electron approximation and the general quantum-mechanical many-body problem. Selected advanced topics.

PS 757—Theory of Atomic and Molecular Structure 2. 3 credits
Identical with CY 757. Prerequisite: PS 756. Continuation of PS 756.

PS 764—Theory of Nuclear Spectroscopy. 3 credits
Prerequisite: PS 661. Racah algebra; single-particle shell model; two, three or more particle systems; electromagnetic properties of nuclei.

PS 765—Theoretical Meson Physics. 3 credits
Prerequisite: PS 661. Experimental and phenomenological aspects of n-p and p-p scattering, the meson theory of nuclear forces, the N-N interaction in the inelastic region.

PS 766—Theoretical Meson and Nuclear Physics. 3 credits
Prerequisite: PS 765. Advanced topics related to the nucleon-nucleon interaction, the nuclear many-body problem, Hartree-Fock approach, meson-theoretic approach; current topics involving nuclear and meson fields.

PS 767—Advanced Topics in Meson and Nuclear Physics. 3 credits
Prerequisite: PS 766. Strong-interacting particles, relativistic wave equations, the nucleon anti-nucleon problem, two-boson systems, advanced topics.

PS 768—Theory of Nuclear Spectroscopy and Nuclear Reactions. 3 credits
Prerequisite: PS 764. Deformed nuclei, particle-hold couplings, angular correlations, nuclear reactions, R matrix and dispersion theory, the optical model.

PS 769—Direct Reactions and Nuclear Theory. 3 credits
Prerequisite: PS 768. Direct reactions and nuclear reaction mechanisms, numerical programs for nuclear reactions and nuclear spectroscopy, advanced topics in nuclear reactions, nuclear spectroscopy, nuclear structure.

PS 771—High Energy Theory 1. 3 credits
Prerequisite: PS 672. Field theory, particles, scattering theory, LSZ theory.

PS 772—High Energy Theory 2. 3 credits
Prerequisite: PS 771. Dispersion theory, form factors, current topics.

PS 790—Special Topics. 3 credits
Assigned reading program, seminar, or lecture series in a new field of advanced physics. May be repeated with change of content up to a maximum of 18 credits.

PS 799—Doctoral Research. 1 to 17 credits

PHYSIOLOGY

GRADUATE FACULTY 1970-71

Otis, A. B., *Chairman;* Cassin, C.; Dawson, W. W.; Dragstedt, L. R.; Fregly, M. J.; Jaeger, M. J.; King, R. L.; Munson, J. B.; Stainsby, W. N.

Graduate Coordinator: R. L. King

Prerequisites: Undergraduate majors that are appropriate foundations for the study of physiology are biology, chemistry, engineering, mathematics, or physics. The following courses are especially useful as a background for the study of physiology: general biology, vertebrate biology, general chemistry, analytical chemistry, organic chemistry, physical chemistry, general physics, calculus, and statistics. Students usually find it necessary to remedy deficiencies in their background by taking a few undergraduate courses after admission to Graduate School.

Course requirements: Most students will take the following unless equivalent courses have been taken elsewhere: MED 503, MED 534, BCH 601, BCH 602, BCH 603, BCH 605, MED 520, MED 521, MED 522, MED 523, MED 619, MED 620, MED 621, MED 622, MED 623, MED 625, MED 626, MED 627, MED 628, MED 629, MED 636, MED 637, and MED 638. A minor field is not required but may be chosen in another deparment of the College of Medicine, such as neuroscience or immunology and medical microbiology, or elsewhere in the University in such departments as zoology, chemistry, biochemistry, physics, or psychology.

Thesis: Satisfactory completion of a thesis based on research is a requirement for a graduate degree. The research may be carried out in any of a number of areas of physiology, including neurophysiology, endocrinology, respiration, circulation, physiology of muscle, environmental physiology, comparative physiology, and neonatal physiology.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

MED 518—Vision. 4 credits
MED 520—Physiological Mechanisms. 5 credits
MED 521—Method and Techniques of Physiology. 2 credits
MED 522—Physiological Regulations. 5 credits
MED 523—Experimental Physiology. 2 credits

GRADUATE COURSES

MED 619—Physiology of Respiration. 3 credits
Gas exchange in lungs and tissues. Ventilatory mechanics. Respiratory functions of body fluids. Physiological regulations. Comparative physiology of respiratory mechanisms.

MED 620—Physiology of the Circulation of Blood. 3 credits
Physiology of the component parts of the circulation, relation of structure and function, emphasis on control mechanisms.

MED 621—Renal Physiology. 3 credits
Comparative physiology aspects of renal structure and function covered in seminars.

MED 622—Physiology of the Central Nervous System. 3 credits
Special and current problems in brain and spinal cord function covered in seminars.

MED 623—Neurophysiology. 3 credits
Physiology of nerve and muscle, central nervous system, and the special senses. Comparative aspects emphasized.

MED 625—Body Temperature Regulation. 3 credits
Neural and endocrine aspects of temperature regulation, hypo- and hyperthermia, adaptation to cold and heat, hibernation. Comparative physiology of temperature regulation stressed.

MED 626—Recent Advances in Physiology. 3 credits
Content varies from year to year but covers recent advances in physiology. May be repeated with change of content up to a maximum of 15 credits.

MED 627—Research Methods in Physiology. 2 to 6 credits
The special needs of each student met by conferences and laboratory work. May be repeated with change of content up to a maximum of 9 credits.

MED 628—Seminar in Physiology. 1 credit

MED 629—Neonatal Physiology. 3 credits
Physiological regulation in newborn mammals.

MED 636—Survey of Sensory Systems. 4 credits
Identical with PSY 623. Prerequisite: MED 623 or PSY 600. Theories and data on human sensory reception and encoding. Audition, vision, and the chemical and cutaneous senses.

MED 637—Seminar on Vision. 4 credits
Identical with PSY 629. Prerequisite: MED 623 or PSY 600. Selected current research and theory in visual function.

MED 638—Physiology of the Mammalian Thyroid Gland. 3 credits
Production, secretion, control, and function of the thyroid hormones; interaction with other hormones.

PLANT PATHOLOGY

GRADUATE FACULTY 1970-71

Purdy, L. H., *Chairman;* Bartz, J. A.; Cook, A. A.; Crill, J. P.; Decker, P.; Freeman, T. E.; Hiebert, E.; Kucharek, T. A.; Luke, H. H.; Miller, C. R.; Miller, H. N.; Mullin, R. S.; Purcifull, D. E.; Roberts, D. A.; Schenck, N. C.; Schmidt, R. A.; Stall, R. E.; Zettler, F. W.

Graduate Coordinator: D. A. Roberts

The Department of Plant Pathology offers graduate studies leading to the Master of Agriculture, Master of Science, and Doctor of Philosophy degrees. A superior student with a baccalaureate degree may begin graduate study toward a higher degree in the basic areas of plant pathology with emphasis on bacterial, fungal, and viral plant pathogens. Specializations within these areas include: biochemical aspects of host pathogen systems, epidemiology, etiology, genetics of host-pathogen systems, physiology, and taxonomy. The diversity of cropping sequences coupled with an environment ideal for plant disease development in Florida is unexcelled and offers the student opportunities of study with diseases of unique crops as well as diseases of crops of national and international importance. Intimate knowledge can be gained of diseases of field, forage, forest, fruit, ornamental, pasture, range, turf, and vegetable crops in temperate, sub-tropical, and tropical environments. Students who anticipate study in plant pathology at the University of Florida should include in their undergraduate program training in: botany (anatomy, cytology, physiology, systematics), chemistry (through organic), introductory bacteriology, physics, zoology, one foreign language, and mathematics.

After termination of the first quarter in residence all students will be given an oral examination covering the general and specialized areas of plant pathology. Course requirements will be determined for each individual based on his performance on the examination as well as his background and objectives.

The Departments of Botany and Entomology-Nematology offer courses in, respectively, Mycology and Nematology.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

PT 500—Problems in Plant Pathology. 1 to 3 credits
PT 501—Intermediate Plant Pathology. 5 credits
PT 502—Principles of Plant Disease Control. 3 credits
PT 540—Transmission of Plant Pathogens by Vectors. 3 credits
PT 541—Tropical Plant Pathology. 4 credits

GRADUATE COURSES

PT 600—Colloquium in Principles of Plant Pathology. 1 credit
May be repeated with change of content up to a maximum of 6 credits.

PT 611—Plant Virology Lecture. 3 credits
Principles of plant virology; symptomatology, transmission, insect-vector relationships, properties of viruses, purification, electron microscopy, morphology, serology, and control of viral diseases.

PT 612—Plant Virology Laboratory. 2 credits
Prerequisite or corequisite: PT 611. Methods of research in plant virology.

PT 621—Bacterial Plant Pathogens. 5 credits
Prerequisite: MCY 302. Plant pathogenic bacteria, with emphasis on bacteriological problems unique in plant pathology.

PT 623—Fungal Plant Pathogens. 5 credits
Prerequisites: PT 502, BTY 521. Diseases caused by fungi, emphasizing taxonomy and variability of the pathogen, symptomology, host responses to infection, and factors influencing disease development.

PT 625—Physiology of Parasitism. 5 credits
Prerequisite: PT 301. Physiological aspects of the host-pathogen interaction in plant diseases.

PT 627—Epidemiology of Plant Disease. 3 credits
Prerequisite: PT 301. Principles of epidemiology; effects of edaphic, biotic, and climatic factors on disease development in populations of plants.

PT 629—Pathogen Variability and Host Resistance. 5 credits
Prerequisites: PT 301, PT 531, MCY 302, AY 465, STA 320. Concepts, methods, and problems associated with development and utilization of disease-resistant germ plasm.

PT 650—Seminar in Plant Pathology. 1 credit
Discussion of the literature, techniques, and research pertaining to plant pathology.

PT 690—Problems in Plant Pathology. 1 to 5 credits
Prerequisite: Consent of instructor. Study of any field of plant pathology including diseases of all major crop groups. May be repeated with change of content up to a maximum of 9 credits.

PT 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PT 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PT 699—Master's Research. 1 to 17 credits

PT 799—Doctoral Research. 1 to 17 credits

POLITICAL SCIENCE

GRADUATE FACULTY 1970-71

Dauer, M. J., *Chairman*; Bartley, E. R.; Clubok, A. B.; Conradt, D. P.; Freels, J. W., Jr.; Hanna, P. L.; Henderson, T. A.; Legg, K. R.; Lemarchand, R.; McQuown, O. R.; Morrison, J. F.; Munger, F. J.; Page, R. E.; Rosenbaum, W. A.; Spanier, J. W.; Suarez, A.; Svarlien, O.

Graduate Coordinator: O. R. McQuown.

Students wishing to take work leading to the degrees of Master of Arts

with thesis, Master of Arts without thesis, and Doctor of Philosophy must have completed an undergraduate major in political science or its equivalent. A student without this undergraduate concentration will take foundation work. As a minimum requirement, half the work for the major for the two Master of Arts degrees must be at the 600 level, including at least one seminar in each field offered; for the Doctor of Philosophy degree, a larger proportion of 600-level work is required, including seminars in each field offered. The degree of Master of Arts in Teaching also is offered.

For the degrees of Master of Arts with thesis and Master of Arts without thesis the student must offer work in two fields of political science and a single or composite minor outside this discipline. The successful completion of an examination or course work in one foreign language is required. Other requirements for the Master of Arts with thesis degree, those for the thesis, are set forth under that heading elsewhere in this catalogue. The Master of Arts without thesis degree requires 54 hours of course work, submission of one or two research papers, and a comprehensive final examination by the supervisory committee. The successful completion of an examination in one foreign language is required. For those candidates for the Master of Arts with thesis degree whose major interest in public administration for government employment and who do not plan to work toward the doctorate, the language requirement may, at the discretion of the supervisory committee and the department, be waived. In the case of such a waiver 6 additional credits of course work will be required.

For the Doctor of Philosophy degree the student will normally pursue a minimum of two years of graduate seminar and course work in preparation for the qualifying written and oral examinations leading to candidacy. A prerequisite to taking these examinations is the successful completion of the language requirement. The qualifying examinations will be in four fields of political science selected by the student with the approval of his graduate supervisory committee from the following: (1) political theory and methodology, (2) American government and politics, (3) comparative government, (4) international relations and organization, (5) international law and organization, (6) public law, (7) public administration and planning. In addition, at the time of the qualifying examinations, the student will be examined in one minor field. Following advancement to candidacy, the third year will be devoted to preparation of the dissertation.

As a part of its graduate program the Department of Political Science offers professional preparation for careers in international affairs, as well as a program in public administration preparing for government service and for university teaching and research in public administration.

For special degree programs in international relations and in Latin American studies, see section entitled *Special Programs*.

Attendance by each graduate student majoring in political science is required at the monthly hour-and-a-half departmental colloquium. At this colloquium there will be discussion of papers written by staff and by graduate students. No more than three of the 500-level courses may be taken for graduate

major credit; however, students electing PCL 530 may acquire 12 credits. Additional work in these courses is required of graduate students.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

PCL 505—Government of the Soviet Union and Eastern Europe. 5 credits
PCL 506—Eastern European Communist States. 5 credits
PCL 507—British Political Model in the Commonwealth. 5 credits
PCL 508—Modes of Politics in Western Europe. 5 credits
PCL 509—American Foreign Policy. 5 credits
PCL 511—Smaller European States. 5 credits
PCL 512—Urban, Suburban, and Metropolitan Government. 5 credits
PCL 514—Problems of Administration and Policy. 5 credits
PCL 516—Administration of Justice. 5 credits
PCL 517—Legislation. 5 credits
PCL 518—Political Opinion. 5 credits
PCL 520—Political Parties. 5 credits
PCL 521—The Presidency. 5 credits
PCL 522—Government in the Far East. 5 credits
PCL 524—Comparative Foreign Policy. 5 credits
PCL 526—Government and Politics of the Developing Countries. 5 credits
PCL 527—International Organization and Administration: Policies and Functions. 5 credits
PCL 528—African Governments and Politics. 5 credits
PCL 530—Individual Work. 5 credits
PCL 540—International Relations of the American Republics. 5 credits
PCL 541—Government and Politics of South America. 5 credits
PCL 542—Government and Politics of the Caribbean Countries. 5 credits
PCL 543—Government and Politics of Brazil. 5 credits
PCL 547—National Security and Defense Policy. 5 credits
PCL 552—Politics of the Environment. 5 credits
PCL 591—Masterpieces in the Social Sciences 1. 4 credits
PCL 592—Masterpieces in the Social Sciences 2. 4 credits
PCL 593—Masterpieces in the Social Sciences 3. 4 credits

GRADUATE COURSES

PCL 601—Political Science Scope and Method. 5 credits

Prerequisite: Permission of department. Science in relation to social sciences. Development of political science. Micro vs. macro approaches. Political science research strategies. Normative and value approaches and problems.

PCL 604—Public Administration Problems. 5 credits

Organizational structure; recruitment; development of leadership; development of organizational effectiveness. Open only to students with A.B. degree working for terminal master's degree in public administration, to qualify for federal, state, or local government management.

PCL 605—Public Administration Procedures. 5 credits

Prerequisite: PCL 604. Decision-making; budget planning and formulation; ethics in administration. Open only to students with A.B. degree working for terminal master's degree in public administration, to qualify for federal, state, or local government management.

PCL 606—Public Administration Internship. 5 credits

Prerequisites: PCL 604, PCL 605. Supervised internship under a major local government administrator, with seminar sessions to develop research project. Open only to students with A.B. degree working for terminal master's degree in public administration to qualify for federal, state, or local government management.

PCL 613—The Conduct of Inquiry. 5 credits

Empirical research methodology in political science.

PCL 614—Political Behavior: Polimetrics 1. 5 credits

PCL 615—Survey Research. 5 credits

Identical with SY 648. Prerequisite: STA 320. Methods of survey research in context of field investigation. Formulation of research hypotheses predicted by theory; construction of measuring instruments; collection, analysis of data.

PCL 616—Seminar in Political Theory. 5 credits

Problems in political theory. Idealism vs. pragmatism. Theories as to the scope of government. Authority vs. individualism.

PCL 617—Seminar in Political Theory. 5 credits

Continuation of PCL 616. Theories of political causation and absolute government.

PCL 618—Seminar in Political Behavior: Polimetrics 2. 5 credits

PCL 619—History of American Political Theory. 5 credits

Background of American theory. Historical treatment from the Mayflower Compact to the contemporary period.

PCL 620—Latin American Political Theory. 5 credits

Prerequisites: A reading knowledge of Spanish and undergraduate work in Latin American government. Writings and theories of the leading Latin American political thinkers from Alberdi, Sarmiento and Marti to contemporary figures.

PCL 621—Political Model Building. 5 credits

Prerequisites: Graduate standing in political science, math sequence through and including MS 211; MS 304 (calculus sequence); STA 320 or STA 520; ISE 350 (Fortran). Mathematical and statistical applications of political model building, including computer simulation.

PCL 622—Seminar in Public Administrative Behavior. 5 credits

Public administration, with emphasis on the units of analysis and contributions of each approach to general understanding of the field.

PCL 623—Seminar in Public Administrative Behavior. 5 credits

Major methodologies used in the approaches covered in PCL 622.

PCL 624—Seminar in Comparative Public Administration. 5 credits

Prerequisites: PCL 622; advanced courses in comparative government. Organization and approaches, especially as determined by varying political, social, and economic environmental factors, among bureaucracies in various parts of the world.

PCL 627—Seminar in International Relations and Organization 1. 5 credits

Basic forces, problems, and developments in international politics and organization.

PCL 628—Seminar in International Relations and Organization 2. 5 credits

Continuation of PCL 627.

PCL 630—Individual Work. 1 to 5 credits

Reading or research in areas of political science needed by graduate students. May be repeated with change of content up to a maximum of 16 credits.

PCL 639—Seminar in Public Law 1. 5 credits

Judicial interpretation and enforcement of written constitutions. Separation of powers. The American federal system. Powers of the federal government. Due process and equal protection.

PCL 640—Seminar in Public Law 2. 5 credits

Continuation of PCL 639.

PCL 643—Seminar in International Law 1. 5 credits

International law, including the law of international organization.

PCL 644—Seminar in International Law 2. 5 credits

Continuation of PCL 643.

PCL 650—Seminar in Government and the Planning Process. 5 credits

Governmental planning. Case studies of federal, regional, state, and local planning agencies. Planning as a governmental process.

PCL 652—Seminar in Metropolitan Problems. 5 credits

Modern social science techniques in the analysis of problems of metropolitan areas, especially political problems of overlapping units of government.

PCL 653—Seminar in Problems of American Federal Government. 5 credits

Problems in American federal government and administration.

PCL 654—Seminar in State Government and Politics. 5 credits

The bibliography, methodology, and research topics of American state and local governments.

PCL 655—Seminar in Political Parties. 5 credits

Group politics in one-party and two-party states, machine and nonmachine states. Parties as legal agencies and as autonomous ones. Organization of parties, committees, conventions vs. primaries, etc. Comparative treatment of parties of certain foreign states.

PCL 660—Seminar in Comparative Government 1. 5 credits

The major institutions, functions, and problems of representative major foreign political systems. Methodology and bibliography of comparative government and politics.

PCL 662—Comparative Studies in Western European Political Systems. 5 credits

Prerequisite: PCL 660. Directed study and research on Western European countries.

PCL 664—Seminar in Far Eastern Governments and Politics. 5 credits

Prerequisite: PCL 522 or PCL 526. Chinese and Japanese government and politics.

PCL 666—Seminar in Russian and Eastern European Governments and Politics. 5 credits

Political heritage of the Revolution. Structural features of the Soviet system. Lawmaking and public administration. The Soviet state and the individual.

PCL 668—Seminar in African Governments and Politics. 5 credits

Prerequisite: PCL 528 or PCL 526. Directed study and research in African governments and politics.

PCL 670—Seminar in Latin American Government and Politics 1. 5 credits

A knowledge of Spanish or Portuguese is required. French may be substituted with consent of instructor.

PCL 672—Seminar in Latin American Government and Politics 2. 5 credits

Continuation of PCL 670.

PCL 674—Seminar in Brazilian Government and Politics. 5 credits

Prerequisites: Reading knowledge of Portuguese and graduate standing in Latin American Area Studies, PCL 541. The Brazilian government and political parties.

PCL 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

PCL 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

PCL 699—Master's Research. 1 to 17 credits

PCL 799—Doctoral Research. 1 to 17 credits

POULTRY SCIENCE

GRADUATE FACULTY 1970-71

Harms, R. H., *Chairman;* Damron, B. L.; Douglas, C. R.; Fry, J. L.; Roland, D. A.; Voitle, R. A.; Wilson, H. R.

Graduate Coordinator: J. L. Fry

The Department of Poultry Science offers major work for the degrees of Master of Agriculture and Master of Science in Agriculture. Areas of specialization are nutrition, genetics, physiology, poultry and egg products, marketing, and management.

Programs leading to the degree Doctor of Philosophy, with emphasis on problems related to poultry science, may be obtained through the Department of Animal Science with staff members from Poultry Science directing the program.

A departmental prerequisite for admission to graduate study is a sound background in the biological sciences.

The following courses in related areas will be acceptable for graduate credit as part of the candidate's major: AL 607—Physiology of Reproduction; AL 650—Advanced Methods in Nutrition Technology; AL 653—Vitamins; AL 655—Mineral Nutrition and Metabolism; AL 657—Non-ruminant Metabolism; DY 605—Endocrinology; FS 607—Food Chemistry; FS 641—Advanced Human Nutrition.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

PY 514—Poultry Nutrition. 4 credits

PY 522—Poultry Breeding. 3 credits

GRADUATE COURSES

PY 607—Topics in Poultry Production. 2 or 3 credits

Prerequisites: ADP 311, ADP 312. Offered primarily to Agricultural Extension

workers and vocational agriculture teachers. When offered this course is announced with one of the following topics specified: production principles, principles of handling and marketing, or nutrition. May be repeated with change of content up to a maximum of 9 credits.

PY 612—Avian Physiology. 3 to 5 credits
Prerequisite: VY 321. Environmental physiology, ovulation cycle and egg formation, reproductive efficiency, experimental physiological techniques.

PY 614—Advanced Poultry Nutrition. 4 credits
Prerequisites: ADP 312, PY 514. Current topics in poultry nutrition; research techniques; formulation of experimental diets, and linear programming procedures and practice.

PY 617—Problems in Egg and Poultry Meat Technology. 2 to 5 credits
Prerequisite: PY 453. Physical, chemical, and bacteriological aspects in the preparation, storage, and marketing of eggs and poultry meat. May be repeated with change of content up to a maximum of 5 credits.

PY 631—Advanced Poultry Management. 4 credits
Costs and returns in producing eggs, poultry meat, and baby chicks; poultry finances; organization of business.

PY 660—Graduate Seminar in Poultry Science. 1 credit
Discussion of current literature and developments in poultry science. May be repeated with change of content up to a maximum of 3 credits.

PY 664—Topics in Genetics. 2 to 4 credits
Identical with AL 664, AY 664, BTY 696, ZY 664. See AY 664. May be repeated with change of content up to a maximum of 12 credits.

PY 670—Advanced Problems in Poultry Production. 1 to 4 credits
Individual problems in fields of nutrition, genetics, physiology, poultry and egg marketing and processing, and management. May be repeated with change of content up to a maximum of 12 credits.

PY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PY 699—Master's Research. 1 to 17 credits

PSYCHOLOGY

GRADUATE FACULTY 1970-71

Ziller, R. C., *Chairman;* Anderson, R. J.; Barger, B.; Cohen, L. D.; Davis, H. C., Jr.; Dawson, W. W.; Dewsbury, D. A.; Dixon, J. C.; Epting, F. R.; Goldman, J. R.; Grater, H. A., Jr.; Guertin, W. H.; Hall, E. E.; Horne, E. P.; Isaacson, R. L.; Jourard, S. M.; King, F. A.; Levy, C. M., Jr.; Malagodi, E. F.; Margulis, S. T.; Markel, N. N.; McGee, R. K.; Moltola, W. C.; Pennypacker, H. S.; Perry, N.; Satz, P.; Schumacher, A. S.; Shaw, M. E.; Silverman, I.; Suchman, D. I.; Teas, D. C.; Van De Riet, V. D.; Vanhartesveldt, C.; Vierck, C. J., Jr.; Webb, W. B.; Willis, R. D.; Wolking, W. D.

Graduate Coordinator: M. E. SHAW

Undergraduate preparation should include at least one course in experimental psychology and quantitative methods. Other courses in psychology should include at least three or four of the following areas: developmental, learning, perception, personality, physiological, and social.

Except for the Master of Arts in Teaching, students are not accepted for a terminal master's degree. Students accepted for the Ph.D. degree are awarded the M.A. or M.S. degree as a part of the doctoral program. Doctoral areas of specialization include the teaching and research areas of developmental, general experimental, personality, psychobiology, and social psychology; and the professional areas of clinical and counseling. The training programs in clinical and counseling psychology are APA approved.

A predoctoral internship of one year is required for the clinical and counseling psychology specializations.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

PSY 501—ADVANCED GENERAL PSYCHOLOGY. 4 credits
PSY 503—ESSENTIALS OF PSYCHOLOGICAL TESTING 1. 4 credits
PSY 504—ESSENTIALS OF PSYCHOLOGICAL TESTING 2. 4 credits
PSY 506—THEORIES IN SOCIAL PSYCHOLOGY. 4 credits
PSY 508—LABORATORY TOPICS IN ANIMAL BEHAVIOR. 4 credits
PSY 509—CURRENT THEORIES IN PERSONALITY. 4 credits
PSY 512—INDIVIDUAL AND GROUP DIFFERENCES. 4 credits
PSY 514—HISTORY OF PSYCHOLOGY. 5 credits
PSY 516—PHYSIOLOGICAL PSYCHOLOGY. 3 credits
PSY 517—LABORATORY TOPICS IN PHYSIOLOGICAL PSYCHOLOGY. 4 credits
PSY 518—VISION. 4 credits
PSY 520—EXPERIMENTAL ANALYSIS OF BEHAVIOR 1. 4 credits
PSY 521—HUMAN LEARNING. 4 credits
PSY 525—MOTIVATION. 4 credits
PSY 550—COGNITIVE PROCESSES. 4 credits

GRADUATE COURSES

PSY 600—PRO-SEMINAR 1: LITERATURE IN EXPERIMENTAL PSYCHOLOGY. 3 to 6 credits

Empirical and theoretical foundations of various areas of experimental psychology. Required of all first-year graduate students.

PSY 601—PRO-SEMINAR 2: LITERATURE IN EXPERIMENTAL PSYCHOLOGY. 3 to 6 credits

Continuation of PSY 600. Required of all first-year graduate students.

PSY 602—PRO-SEMINAR 3: LITERATURE IN EXPERIMENTAL PSYCHOLOGY. 3 to 6 credits

Continuation of PSY 601. Required of all first-year graduate students.

PSY 603—PSYCHOMETRIC METHODS. 3 credits

Prerequisite: STA 320. Recommended for first-year graduate students. Methods and theory of psychological measurements and scaling.

PSY 604—STATISTICAL METHODS IN PSYCHOLOGY: INFERENCE. 3 credits

Prerequisite: STA 320. Application of inference techniques to psychological data. Sampling theory. Nonparametric procedures, chi square. Analysis of variance.

PSY 605—Statistical Methods in Psychology: Correlation. 3 credits
Prerequisite: STA 320. Application of correlation techniques to psychological data. Linear, nonlinear, and other estimates of relationship. Partial and multiple correlation. Regression and prediction. Test reliability and validity. Factor analysis.

PSY 607—Comparative Psychology. 4 credits
Prerequisite or corequisite: PSY 600. Literature in comparative psychology.

PSY 608—Seminar in Comparative Psychology. 3 credits
Prerequisite: PSY 607. Restricted area of comparative psychology of current importance. May be repeated with change of content up to a maximum of 15 credits.

PSY 609—Seminar in Personality. 4 credits
Prerequisite: PSY 509 or PSY 602. Personality development and dynamics. May be repeated with change of content up to a maximum of 12 credits.

PSY 610—Seminar in Psychopathology. 4 credits
Prerequisites: PSY 301, PSY 509. Review of recent research on developmental, somatic, and cultural factors associated with selected mental disorders. Emphasizes experimental psychopathology.

PSY 611—Advanced Social Psychology 1. 4 credits
Prerequisites: PSY 306, PSY 406, or equivalent. Literature of social psychology, with emphasis on individual behavior.

PSY 612—Advanced Social Psychology 2. 4 credits
Prerequisite: PSY 611. Literature of social psychology, with emphasis upon interpersonal relations.

PSY 613—Children's Behavior Disturbances. 4 credits
Prerequisites: PSY 410; PSY 509 or PSY 602. Behavior disturbances in children and adolescents. Theory, research, and implication for practice.

PSY 614—Development and Appraisal of Vocational Choice. 4 credits
Prerequisite: PSY 503. Theories of vocational development and methods of appraisal in assessing vocational choice.

PSY 616—Seminar: Social Psychology. 4 credits
Prerequisite: PSY 612. Topics in social behavior, with emphasis on current theory and research. May be repeated with change of content up to a maximum of 15 credits.

PSY 617—Laboratory in Social Psychology 1. 4 credits
Prerequisite: PSY 616. Design and analysis of experiments pertaining to social phenomena, with emphasis on recent developments in the field.

PSY 618—Laboratory in Social Psychology 2. 4 credits
Prerequisite: PSY 617. Experimental studies in social psychology.

PSY 619—Advanced Experimental Psychology 1. 4 credits
Prerequisite: PSY 301 or PSY 302. Experimental studies in psychophysics, including scaling, sensation, perception, attention, association, reaction time.

PSY 620—Experimental Analysis of Behavior 2. 4 credits
Prerequisite: PSY 520. Continuation of PSY 520. Experimental design, areas of research, and laboratory technology. Laboratory work required.

PSY 621—Applied Behavior Analysis. 4 credits
Continuous, direct recording of human behavior. Tactics of behavior management. Research methods in applied behavior analysis.

PSY 622—Seminar: Experimental Psychology. 1 to 5 credits
Prerequisites: PSY 600, PSY 601, PSY 602. Current research, theory, and instruc-

tional techniques. May be repeated with change of content up to a maximum of 15 credits.

PSY 623—Survey of Sensory Systems. 4 credits

Prerequisite: Basic physiology, PSY 627, or MED 623. Theories and data on human sensory reception and encoding. Audition, vision, the chemical and cutaneous senses. Topics presented by students.

PSY 624—Seminar: Perception. 4 credits

Conditions, mechanisms, forms, and functions of perceptual processes.

PSY 626—Seminar: Experimental Design. 4 credits

Prerequisite: PSY 603. Experimental method in psychology. Critical evaluation of selected experiments. Quantitive methodology in experimental planning.

PSY 627—Advanced Physiological Psychology. 2 credits

Current research and theory in physiological psychology with emphasis on physiological bases of learning, memory, motivation, emotion, and reinforcement.

PSY 628—Seminar: Sensory Processes. 4 credits

Current research and theory in the psychobiology of the sensory processes. May be repeated with change of content up to maximum of 8 credits.

PSY 629—Seminar on Vision. 4 credits

Identical with MED 637. Current research and theory in visual function. Literature survey and design of an experiment relevant to recent theory.

PSY 630—Individual Work. 1 to 5 credits

Reading or research in areas of psychology. May be repeated with change of content up to a maximum of 15 credits.

PSY 631—Research Methods in Social Psychology. 4 credits

Prerequisite: PSY 618. Experimental studies in social perception, social influence, attitudes, leadership, interpersonal perception and related social processes. May be repeated with change of content up to a maximum of 15 credits.

PSY 632—Test Construction. 4 credits

Prerequisites: PSY 503, PSY 605. Theory and practice in construction of tests of general aptitude, special aptitude, and personality traits. Psychophysical theory and techniques.

PSY 637—Personal Counseling. 4 credits

Current theories and practices in personal counseling; role of the counselor and nature of the counseling relationship.

PSY 641—Personality Assessment 1. 4 credits

Prerequisites or corequisites: PSY 503, PSY 509. Basic procedures in assessing personality structure and dynamics, including diagnostic interview, case history, objective and projective tests.

PSY 642—Personality Assessment 2. 4 credits

Prerequisites: PSY 600, PSY 601, PSY 602. Advanced procedures in assessing personality structure and dynamics, including diagnostic interview, case history, objective and projective tests.

PSY 643—Personality Assessment 3. 4 credits

Prerequisite: PSY 642. Continuation of PSY 642.

PSY 644—Personality Assessment 4. 4 credits

Prerequisites: PSY 643, PSY 605. Advanced techniques in assessment and prediction.

PSY 646—Human Brain Function. 4 credits

Prerequisites: PSY 600, PSY 601, PSY 602. Recent advances in theory and experimental methods.

PSY 650—Research Methods in Personality. 3 credits
Prerequisites: PSY 601, PSY 602, PSY 605. Theoretical, methodological, and procedural aspects of research in personality. Issues frequently encountered in designing personality research.

PSY 651—Practicum in Professional Psychology. 5 credits
Prerequisites: PSY 637, PSY 643, admission to program in clinical, counseling, or school psychology. Supervised training in appropriate work settings relating theoretical understanding of personality to case handling and consultation through a variety of psychological assessment and treatment procedures. Designed as a sequence of 3 quarters paralleling academic course work. Each succeeding registration requires increasing levels of competence and responsibility. Fifteen credits or equivalent demonstrated competence are recommended for admission to internship, PSY 755. May be repeated with change of content up to a maximum of 15 credits.

PSY 661—Seminar: Developmental Psychology. 4 credits
Life-span approach to the psychological processes of change in the individual from birth to death.

PSY 669—Seminar: Motivation 1. 4 credits
The aversive control of behavior (punishment, avoidance, escape, CER) as related to motivational processes.

PSY 670—Seminar: Motivation 2. 2 credits
Continuation of PSY 669.

PSY 680—Seminar in Developmental Psychology: Cognitive Processes. 4 credits
Prerequisites: PSY 600, PSY 601, PSY 602, PSY 603. Development of cognitive processes in relation to other psychological processes.

PSY 692—Psychophysiology of Hearing. 5 credits
Identical with SCH 692. Physiological representation of acoustic events within the auditory system. Anatomical information and analysis of electrophysiological literature.

PSY 697—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PSY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

PSY 699—Master's Research. 1 to 17 credits

PSY 714—Contemporary Systems in Psychology. 4 credits
Prerequisite: PSY 514. Differences in theoretical viewpoint which give rise to the emphasis responsible for the delineation of distinct systems in modern psychology. Original work of leading theorists and its impact on the science of psychology.

PSY 720—Advanced Seminar: Experimental Analysis of Behavior. 4 credits
Prerequisites: PSY 520, PSY 620. Continuation of PSY 520 and PSY 620. Complex behavior repertoires and areas of application. Laboratory work required.

PSY 726—Advanced Psychometric Methods. 3 credits
Prerequisites: STA 522; PSY 605 or EDF 764. Classification and measurement models. Quantitative analysis of behavioral data. Time dependent processes, information coding, and choice behavior.

PSY 727—Seminar in Neural Mechanisms and Behavior. 2 credits
Prerequisite: PSY 627. Recent and specialized topics in brain-behavior relations.

PSY 734—Seminar: Current Clinical Literature. 4 credits
Reading on selected topics in clinical psychology. May be repeated with change of content up to a maximum of 12 credits.

PSY 735—Issues in Psychological Treatment. 4 credits
Prerequisites: PSY 637, PSY 651. Seminar and case discussion based on critical issues in psychological treatment. May be repeated with change of content up to a maximum of 8 credits.

PSY 736—Seminar: Theory and Research Methods in Community Psychology. 4 credits
Principles of community psychology, including those related to community and program evaluation, consultation, mental health education, early identification, and intervention. Research methods and current research literature.

PSY 737—Theory and Practice of Psychological Consultation. 4 credits
Concepts and practices in psychological consultation, including multiple roles and intervention strategies utilized by consultants as agents of organizational and social system change. Field experience in actual consultation settings in the community.

PSY 738—Seminar: Advanced Research Methods in Community Psychology. 4 credits
Prerequisite: PSY 736. Analyzing a community through methods of epidemiological and demographic data collection. Design of research for program evaluation and program planning in the community.

PSY 743—Psychodiagnostic Appraisal and Assessment. 4 credits
Prerequisite: PSY 643. Synthesis of theory and practice of psychodiagnosis. Utilization of personality test batteries and other data oriented toward both individual case study and group assignment.

PSY 750—Advanced Theories in Personality. 4 credits
Prerequisites: PSY 509 or PSY 602; PSY 609. Theoretical orientations in personality and research developments; particular groups of theorists examined.

PSY 755—Internship. 5 credits
Prerequisite: PSY 651. Students in applied specializations placed in approved intern settings. Designed as a sequence of 3 quarters which must include a minimum of 1,500 work hours. Reading assignments and conferences. Required of all doctoral students in clinical, counseling, and school psychology.

PSY 799—Doctoral Research. 1 to 17 credits

RADIOLOGY

GRADUATE FACULTY 1970-71

Williams, C. M., *Chairman*; Billen, D.; Brookeman, V. A.; Collett, W. K.; Cromroy, H. L.; Dunavant, B. G.; Mauderli, W.; Roessler, C. E.

Graduate Coordinator: B. G. Dunavant

The Department of Radiology offers a program leading to the Master of Science degree in radiation biophysics (Radiological Sciences).

Prerequisites: The basic requirement for admission to the graduate program is a bachelor's degree in an approved program in mathematics, engineering, or the physical or biological sciences. The following courses are considered especially useful as background for the study of radiation biophysics: general chemistry, general and modern physics, statistics, general

biology, and organic chemistry. Calculus is highly recommended. If the student has not already taken PS 460, BLY 565, NES 540, or MED (or EGC) 508, he will be expected to take these courses early in his program.

Course requirements: In addition to those listed above, most students will be required to take MED 680, MED 682, MED 684, and MED 689. MED 699 is required for all students majoring in radiation biophysics.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

MED 508—Fundamentals of Radiation Protection. 4 credits

GRADUATE COURSES

MED 680—Radiological Physics. 4 credits

X-ray generators, including high-energy electron accelerators and interaction of electromagnetic radiation with matter relative to medical radiology.

MED 681—Health Physics. 4 credits

Prerequisites: MED 508, NES 540, or consent of instructor. Techniques of hazard evaluation and radiation control; monitoring methods; survey techniques; biological sampling; instrument calibration; exposure standards and radiation protection regulation; on-site radiation safety surveys and evaluation.

MED 682—Instrumentation and Dosimetry in Radiology. 4 credits

The electronics of diagnostic and therapeutic x-ray units; image amplifying tubes; video equipment in diagnostic radiology; dosimetry instrumentation, including ionization chambers, semiconductors, and luminescent devices; measurement in roentgens; measurement of absorbed radiation energy; calculation of internal dose from implanted sources and radiation beams.

MED 683—Radioactive Tracer Instrumentation and Methodology. 4 credits

Prerequisite: BLY 565. Analytical use of radioisotopes and activation analysis; preamplifiers, linear amplifiers, scalers, single and multichannel analyzers in gamma ray spectrometry; beta and gamma-ray liquid scintillation detectors; tracer experiments, sample preparation, data analysis, and efficiency calculations.

MED 684—Radiation Effects on Humans. 4 credits

Prerequisite: MED 680. Somatic and genetic radiation effects; acute and chronic radiation exposure; pathology; psychological and epidemiological aspects; fundamentals of the application of radiation for treatment of disease.

MED 685—Computer Applications in Medicine. 4 credits

Corequisite: FORTRAN programming course. Review of programming fundamentals (including use of computer at Computing Center, and remote terminal usage), medical problems, data preparation and representation, simulation, information retrieval, problems in radiation biophysics with emphasis on radiation treatment planning.

MED 686—Nuclear Medicine Procedures. 4 credits

Prerequisite: MED 688 and consent of instructor. Application of radioactive materials for diagnosis in medicine; *in-vitro* and *in-vivo* procedures such as hematological procedures, thyroid function tests, organ imaging, and dynamic function studies; internal dosimetry; radiopharmaceutical techniques.

MED 687—Problems in Radiation Biophysics. 3 credits

Selected topics dealing with radiation physics and radiation biology. May be repeated with change of content up to a maximum of 6 credits.

MED 688—Nuclear Medicine Instrumentation. 4 credits

Prerequisite: NES 540 and consent of instructor. Review of basic detection systems; theory and evaluation of instruments used in nuclear medicine; includes scintillation probes, scanners, imaging cameras, whole body counters, collimators and data handling devices.

MED 689—Seminar in Radiation Biophysics. 1 credit

Required of graduate students in radiation biophysics; open to others by permission of the department. Discussion in radiological health administration, radiation epidemiology, and research. May be repeated with change of content up to a maximum of 3 credits.

MED 699—Master's Research. 1 to 17 credits

REAL ESTATE AND URBAN LAND STUDIES

GRADUATE FACULTY 1970-71

Matthews, C. A., *Acting Chairman;* Curtis, C. C.; Hess, N. R.; Stone, L. D.

Graduate Coordinator: C. C. Curtis.

Though no graduate major may be completed without adequate course work on the 600 or higher level, certain undergraduate courses in real estate are available for graduate credit as part of a candidate's major. These are: RE 490—Real Estate Appraising; RE 480—Real Estate Finance.

For admission to courses listed below, the student must have had undergraduate courses in fields pertinent to the graduate courses selected; or, where necessary, special arrangements may be made with the approval of the department chairman.

GRADUATE COURSES

RE 630—Individual Work. 4 credits

Prerequisite: Permission of department. Reading or research in real estate and urban land studies. May be repeated with change of content up to a maximum of 12 credits.

RE 650—Real Estate Investments, Principles and Practices. 4 credits

Real estate from the investor's point of view. Impact of taxation on real estate investments. Emphasis on case studies and problems.

RE 660—Research in Real Estate Brokerage, Management and Law. 4 credits

Methods and practices of real estate brokerage, analysis of real property management as it affects brokerage practices.

RE 670—Problems of Urban Growth and Regional Planning. 4 credits

Economic factors which provide the basis of the urban economy and urban growth. Urbanization; regional planning; locations of cities and industries; private and public controls over urban land utilization and their impact upon the future of cities.

RE 680—Problems in Real Estate Finance. 4 credits

Mortgage risk analysis, mortgage risk rating, trading on the equity, long and

short term financing, problems encountered in slum clearance, subdivision, and urban redevelopment.

RE 690—Problems in Property Valuation. 4 credits

Techniques and problems of income-producing properties. Class work coordinated with field investigation and field reports.

RE 699—Master's Research. 1 to 17 credits

REHABILITATION COUNSELING

GRADUATE FACULTY 1970-71

Thomason, B., *Chairman;* McEver, M. L.; Muthard, J. E.; Sieka, F. L.; Taylor, R. D.

Graduate Coordinator: B. Thomason

GRADUATE COURSES

RC 600—An Introduction to Rehabilitation Counseling. 4 credits

The rehabilitation process, including a survey of history, principles, philosophy, and legal aspects of rehabilitation and related fields.

RC 601—Psychological and Sociological Aspects of Rehabilitation Counseling. 5 credits

Personal and social problems of the physically, mentally, behaviorally, and culturally handicapped as viewed through the behavioral and social sciences. Emphasis on somatopsychological principles.

RC 602—Occupational Analysis and Placement Aspects of Rehabilitation Counseling. 4 credits

The vocational structure of society, occupational skills, occupational entry requirements, and physical and emotional demands. Adaption of occupational information to rehabilitation counseling, including job analysis, placement, and follow-up techniques.

RC 603—Medical and Related Aspects of Rehabilitation Counseling. 5 credits

Medical implications for rehabilitation counselors, including anatomy, physiology, pathology of human systems, physical restoration and etiology, prognosis and therapy of the various disabling conditions.

RC 604—Rehabilitation Evaluation and Counseling with the Disabled. 5 credits

Prerequisites: PSY 503 or EDC 613; PSY 637 or EDC 610. Application of evaluation, counseling theory and technique to rehabilitation of disabled. Approaches in counseling the disabled; emphasis on techniques in practical situations; interviewing and specific testing procedures as vehicles of counseling. Limited classroom experience in counseling.

RC 630—Individual Work. 3 to 6 credits

Allows graduate students in rehabilitation counseling to pursue work not available in other courses. May be repeated with change of content up to a maximum of 6 credits.

RC 644—Research in Vocational Rehabilitation. 4 credits

Prerequisite: STA 320 or EDF 360. Departmental research study in the vocational rehabilitation of the disabled.

RC 645—Practicum in Rehabilitation Counseling. 2 to 10 credits
Supervised individual counseling. May be repeated with change of content up to a maximum of 10 credits.

RC 646—Internship in Rehabilitation Counseling. 10 credits
Supervised field work in a recognized rehabilitation facility, including counseling, case studies, contacts with community social agencies, and the vocational placement of disabled individuals. No student will be allowed to begin internship until 36 credits of degree requirement are completed.

RC 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

RC 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

ROMANCE LANGUAGES AND LITERATURES

GRADUATE FACULTY 1970-71

Conner, J. W., *Chairman*; Abraham, C. K.; Allen, J. J.; Bonneville, D. A.; Casagrande, J.; Der-Houssikian, H.; Diller, G. T.; Gay-Crosier, R.; Hayes, F. C.; Hower, A.; Ibarra, F.; Lasley, M. M.; Reid, J. T.; Saciuk, B.; Schmeling, G. L.; Smith, A. B.; Wallace, M. J.; Wershow, I. R.

Graduate Coordinators: R. Gay-Crosier (French); J. J. Allen (Spanish)

The department offers work leading to the master's degree in French, Latin, and Spanish; and to the Ph.D. degree in French or Spanish. In addition, sufficient courses for a graduate minor are available in Portuguese and Greek.

The *prerequisite* for admission to graduate work is an undergraduate major in the language, including advanced courses in both literature and language. A good foundation in a second language is desirable.

Candidates for the Ph.D. are required to take FLE 619 and FH or SH 610. They must also demonstrate a reading knowledge of Latin and one other foreign language appropriate to their area of specialization.

GRADUATE COURSES

FLE 619—Introduction to Romance Linguistics. 5 credits
Comparative study of the major Romance languages and their development from Latin.

FLE 625—Medieval Romance Lyric Poetry. 5 credits
Reading of representative lyrics, with attention to their cultural setting and to problems of origin and influence.

FRENCH

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

FH 504—French Phonetics. 4 credits

FH 505—Advanced French Composition. 5 credits

FH 506—The Structure of French. 4 credits
FH 512—History of the French Language. 4 credits
FH 517—French Medieval Literature. 4 credits
FH 519—16th-Century French Literature. 4 credits
FH 521—17th-Century French Prose. 4 credits
FH 523—17th-Century French Drama. 4 credits
FH 530—The Philosophic Movement. 4 credits
FH 531—The Novel of the 18th Century. 4 credits
FH 542—The Romantic Period. 4 credits
FH 545—French Realism and Naturalism. 4 credits
FH 550—Modern French Poetry. 4 credits
FH 560—20th-Century French Literature. 4 credits

GRADUATE COURSES

FH 600—Special Study in French Literature. 5 credits
Selected topic or problem (varied each quarter). May be repeated with change of content up to a maximum of 15 credits.

FH 602—Beginning French for Graduate Students 1. 4 credits
Prerequisite: Graduate status. For students with no formal preparation who need to acquire a reading knowledge. Credits do not count toward any graduate degree.

FH 603—Beginning French for Graduate Students 2. 4 credits
Prerequisites: Graduate status; FH 602 or the equivalent. For students working to acquire proficiency in reading. Credits do not count toward any graduate degree.

FH 605—Individual Work. 2 to 5 credits
Available only by special arrangement with a graduate adviser. May be repeated with change of content up to a maximum of 15 credits.

FH 606—Special Study in French Linguistics. 5 credits
May be repeated with change of content up to a maximum of 15 credits.

FH 610—Introduction to Graduate Study and Research. 5 credits
Tools, problems, and methods of literary and linguistic research.

FH 615—Literary Criticism in France. 5 credits
FH 618—Old French Literature 1. 5 credits
FH 619—Old French Literature 2. 5 credits
FH 620—French Poetry of the Renaissance. 5 credits
FH 621—French Prose of the Renaissance. 5 credits
FH 641—Baroque and Preclassicism. 5 credits
FH 645—French Classical Comedy. 5 credits
FH 660—The French Symbolist Movement. 5 credits
FH 670—Contemporary French Novel. 5 credits
FH 671—Contemporary French Theater. 5 credits
FH 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

FH 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

FH 699—Master's Research. 1 to 17 credits
FH 799—Doctoral Research. 1 to 17 credits

LATIN

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

LN 599—Special Study in Latin. 4 credits

GRADUATE COURSES

LN 600—Special Study in Latin Literature. 5 credits
Sample topics: Horace, Juvenal, Roman Comedy, Roman Historians. May be repeated with change of content up to a maximum of 15 credits.

LN 620—History of the Latin Language. 5 credits

LN 630—Individual Work. 3 to 5 credits
Readings, conferences, and reports. Subjects in language, literature, and civilization for which there are no special course offerings. May be repeated with change of content up to a maximum of 15 credits.

LN 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

LN 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

LN 699—Master's Research. 1 to 17 credits

PORTUGUESE

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

PE 504—Portuguese Phonetics and Phonology. 4 credits

PE 551—Machado de Assis and His Contemporaries. 4 credits

PE 552—Eca de Queiros and His Contemporaries. 4 credits

GRADUATE COURSES

PE 600—Special Study in Brazilian or Portuguese Literature. 3 to 5 credits
Selected topic or problem (varied each quarter). May be repeated with change of content up to a maximum of 15 credits.

PE 651—The 19th-Century Brazilian Novel. 5 credits

PE 652—The 20th-Century Brazilian Novel. 5 credits

PE 653—Brazilian Poetry and Drama to 1900. 5 credits

PE 654—Brazilian Poetry and Drama since 1900. 5 credits

PE 660—Medieval and Renaissance Portuguese Literature. 5 credits
May be repeated with change of content up to a maximum of 15 credits.

SPANISH

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

SH 504—Spanish Phonetics. 4 credits

SH 505—Advanced Composition and Syntax. 5 credits

SH 506—The Structure of Spanish. 4 credits

SH 512—History of the Spanish Language. 4 credits

SH 513—Spanish Lyric Poetry. 4 credits

SH 521—Spanish Drama of the Golden Age. 4 credits
SH 522—Spanish Prose Fiction of the Golden Age. 4 credits
SH 531—Spanish Drama of the 19th Century. 4 credits
SH 532—Spanish Novel of the 19th Century. 4 credits
SH 541—The Generation of '98. 4 credits
SH 550—Contemporary Spanish Literature. 4 credits
SH 575—Introduction to Spanish-American Literature 1. 4 credits
SH 576—Introduction to Spanish-American Literature 2. 4 credits
SH 577—Spanish-American Prose Fiction. 4 credits

GRADUATE COURSES

SH 600—Special Study in Spanish or Spanish-American Literature. 5 credits
Selected topic or problem (varied each quarter).
SH 605—Individual Work. 2 to 5 credits
Available only by special arrangement with a graduate adviser. May be repeated with change of content up to a maximum of 15 credits.
SH 606—Special Study in Spanish Linguistics. 5 credits
May be repeated with change of content up to a maximum of 15 credits.
SH 610—Introduction to Graduate Study and Research. 5 credits
Tools, problems, and methods of literary and linguistic research.
SH 618—Old Spanish Literature 1. 5 credits
SH 619—Old Spanish Literature 2. 5 credits
SH 625—Spanish Poetry of the Golden Age. 5 credits
SH 635—Lope de Vega and His Contemporaries. 5 credits
SH 637—Cervantes 1. 5 credits
SH 638—Cervantes 2. 5 credits
SH 640—The Picaresque Novel. 5 credits
SH 655—Gaucho Literature. 5 credits
SH 660—The Modernist Movement. 5 credits
SH 665—The Spanish-American Essay. 5 credits
SH 667—Contemporary Spanish-American Novel. 5 credits
SH 685—Contemporary Spanish Novel. 5 credits
SH 686—Contemporary Spanish Theater. 5 credits
SH 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
SH 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.
SH 699—Master's Research. 1 to 17 credits
SH 799—Doctoral Research. 1 to 17 credits

SECONDARY EDUCATION

GRADUATE FACULTY 1970-71

Todd, E. A., *Chairman;* Ackerman, T. J.; Alexander, W. M.; Arnold, L. A.; Bingham, N. E.; Bolduc, E. J.; Casteel, D.; Crews, J. W.; Crews, R.; Davis, E. A.; Durrance, C. L.; Ellis, B. R.; Hass, C. G.; Hipple, T. W.; Kidd, K. P.; McGuire, V.; Myers, R. B.; Plunkett, B. K.; Scrafford, R. A.; Timmerman, M. E.; Williams, E. L.

Graduate Coordinator: E. A. TODD

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

EDS 550—TEACHING MATHEMATICS IN THE JUNIOR HIGH SCHOOL. 4 credits
EDS 551—TEACHING ALGEBRA IN THE SECONDARY SCHOOL. 4 credits
EDS 552—TEACHING GEOMETRY IN THE SECONDARY SCHOOL. 4 credits
EDS 560—TEACHING SCIENCE IN THE SECONDARY SCHOOL. 4 credits
EDS 564—TEACHING THE PHYSICAL SCIENCES IN THE SECONDARY SCHOOL. 4 credits
EDS 565—TEACHING THE EARTH SCIENCES IN THE SECONDARY SCHOOL. 4 credits
EDS 577—TEACHING READING IN SECONDARY SCHOOLS AND COLLEGES. 4 credits
EDS 590—STUDENT ACTIVITIES IN THE SECONDARY SCHOOL. 4 credits

GRADUATE COURSES

EDS 601—THE JUNIOR HIGH SCHOOL CURRICULUM. 4 credits
Scope and function of the modern junior high school as a school program to meet the needs of early adolescence.

EDS 602—THE SECONDARY SCHOOL CURRICULUM. 4 credits
Scope, function, and types of secondary school curricula and ways of improving existing programs.

EDS 604—CURRICULUM DEVELOPMENT LABORATORY. 4 credits
Guided experiences in developing resource units for teaching and in the writing of courses of study.

EDS 605—EVALUATION IN THE SECONDARY SCHOOL PROGRAM. 4 credits
Procedures and techniques of evaluation in secondary schools.

EDS 611—THE CORE PROGRAM IN THE SECONDARY SCHOOL. 4 credits
Organization, methods, and materials used in core classes.

EDS 630—INDIVIDUAL WORK. 2 to 5 credits
For advanced students who wish to study problems in secondary education under faculty guidance. May be repeated with change of content up to a maximum of 15 credits.

EDS 635—SUPERVISION OF PRE-SERVICE TEACHERS. 4 credits
Function of the directing teacher in the student teaching program and problems and procedures of supervising the work of student teachers.

EDS 640—SOCIAL STUDIES IN THE SECONDARY SCHOOL. 4 credits
Prerequisite: Preparation in the subject area equivalent to requirements for high school certification. Problems of teaching social studies.

EDS 641—ECONOMIC EDUCATION IN THE SECONDARY SCHOOL. 4 credits
Workshop designed to increase understanding of our national economy by a study of fundamental principles and concepts, and to plan for more and better teaching of economic understandings. Offered by extension only.

EDS 650—MATHEMATICS IN THE SECONDARY SCHOOL. 4 credits
Prerequisite: Preparation in subject area equivalent to requirements for high school certification. Patterns of mathematics curriculum in the secondary school; practices in teaching mathematics; preparation, selection, and use of instructional materials; laboratory experiences in field work and in classroom teaching.

EDS 651—Algebra in the Modern Secondary School. 4 credits
Prerequisite: EDS 650. Content and development of algebra with emphasis on teaching in the modern secondary school.

EDS 652—Geometry in the Modern Secondary School. 4 credits
Prerequisite: EDS 650. Content and development of geometry with emphasis on teaching in the modern secondary school.

EDS 660—Science in the Secondary School. 4 credits
Prerequisite: Preparation in subject area equivalent to requirements for high school certification. Current problems in teaching science in secondary schools and junior colleges.

EDS 663—The Biological Sciences in the Secondary School. 4 credits
Current practices in teaching biology; historical and psychological bases from which they evolved; methods of inquiry; the structure of biology with selected concepts from the newer programs developed by investigatory approaches.

EDS 664—The Physical Sciences in the Secondary School. 4 credits
Current practices in the teaching of the physical sciences; historical and psychological bases from which they evolved; methods of inquiry; the structure of physics and/or chemistry with selected concepts from the newer physics and chemistry programs developed by investigatory approaches.

EDS 666—The Teaching of Science to Educationally Disadvantaged Underachievers. 4 credits
Preparation to teach science to economically deprived, underachieving youth. Designed for special groups of students. May be repeated with change of content up to a maximum of 8 credits.

EDS 670—Language Arts: Language and Composition. 4 credits
Prerequisite: Preparation in subject area equivalent for high school certification. Theory and practice of teaching language and composition, grades 7 to 14.

EDS 671—Language Arts: Literature. 4 credits
Prerequisite: Preparation in subject area equivalent for high school certification. Theory and practice of teaching literature, grades 7 to 14.

EDS 685—Problems of Foreign Language Instruction in Secondary Schools. 4 credits
Prerequisite: EDS 484 or EDS 585. Problems of teaching foreign languages in the secondary school. Surveys new methodology and materials through video tapes of selected teaching situations.

EDS 690—Special Topics. 2 to 5 credits
Prerequisite: Permission of department chairman. May be repeated with change of content up to a maximum of 15 credits.

EDS 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EDS 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EDS 700—Seminar in Secondary Education. 4 credits
Open to advanced graduate students only upon consent of the staff of secondary education. Current research and an overview of the total program in secondary education.

SOCIOLOGY

GRADUATE FACULTY 1970-71

LESLIE, G. R., *Chairman;* ALBRECHT, R. E.; BERARDO, F. M.; BOCK, E. W.; DENMAN, S. B.; EDDY, E. M.; GORMAN, B. L.; IUTAKA, S.; LARSON, R. F.; MONSEES, D.; SAUNDERS, J. V. D.; SMITH, T. L.; SPENCER, G.; VANDIVER, J. S.; WARHEIT, G. J.; WEBBER, I. L.

Graduate Coordinator: R. F. LARSON

Admission to the master's degree program requires at least 36 quarter credits of undergraduate study in the social sciences, including 18 quarter credits in sociology. Students planning to apply for admission should take the Graduate Record Examination at the earliest possible date.

The master's degree program emphasizes training in the core areas of sociological theory and research methods. Limited specialization in a substantive area such as population, Latin American institutions, urban sociology, or rural sociology is possible.

Doctoral candidates develop a formal plan of study based upon the results of a written diagnostic examination taken during the first quarter of residence. When the course work is virtually complete, students write qualifying examinations in five areas including sociological theory, research methods, and general sociology.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

SY 503—DEVELOPMENT OF SOCIOLOGICAL THOUGHT.	4 credits
SY 504—ADVANCED GENERAL SOCIOLOGY.	4 credits
SY 514—SOCIAL FACTORS IN HEALTH AND ILLNESS.	4 credits
SY 518—SOCIAL GERONTOLOGY.	4 credits
SY 522—SOCIAL STRATIFICATION.	4 credits
SY 524—SOCIAL STRUCTURE.	4 credits
SY 529—COMPLEX ORGANIZATIONS.	4 credits
SY 530—INDIVIDUAL WORK.	1 to 5 credits
SY 532—THE AMERICAN FAMILY.	4 credits
SY 533—COMPARATIVE FAMILY SYSTEMS.	4 credits
SY 540—ADVANCED SOCIOLOGICAL MEASUREMENTS.	4 credits
SY 542—METHODS OF SOCIAL RESEARCH.	5 credits
SY 563—MODERNIZATION IN LATIN AMERICA.	4 credits
SY 564—COMPARATIVE SOCIOLOGY: THEORY AND METHODS.	4 credits
SY 572—DEMOGRAPHIC ANALYSIS.	4 credits
SY 580—PRIMARY GROUP INTERACTION.	4 credits
SY 581—COLLECTIVE BEHAVIOR.	4 credits
SY 582—SOCIAL MOVEMENTS.	4 credits
SY 585—JUVENILE DELINQUENCY.	4 credits
SY 586—CRIMINOLOGY AND PENOLOGY.	5 credits
SY 587—ADVANCED STUDIES OF MAJOR SOCIAL PROBLEMS.	4 credits
SY 590—THE SOUTH TODAY.	4 credits
SY 591—MASTERPIECES IN THE SOCIAL SCIENCES 1.	4 credits

SY 592—Masterpieces in the Social Sciences 2. 4 credits
SY 593—Masterpieces in the Social Sciences 3. 4 credits
SY 599—Special Study in Sociology. 4 credits

GRADUATE COURSES

SY 605—The Development of Sociological Theories. 4 credits
Selected sociological classics, their influence on the development of theory, and their present relevance for sociology.

SY 606—Basic Sociological Theories. 4 credits
Basic sociological theories of the modern period.

SY 607—Theory Construction. 4 credits
Contemporary trends concerning sociological theory. Selected strategies for the building of sociological theories.

SY 615—Comparative Studies in Health Systems. 4 credits
Health and illness as social entities and their implications in the overall social setting of societies in various parts of the world.

SY 616—Health Facilities in the Modern Community. 4 credits
Hospital and associated health facilities as social systems in the context of community and society. Social factors in the therapeutic process.

SY 617—Health Professions in the Modern Community. 4 credits
Medical and paramedical professions in terms of the social aspects of recruitment, training, and practice; social organization of medical practice, practitioner-patient relationships and consequences for the therapeutic process.

SY 618—The Sociology of the Aged. 4 credits
Physical, psychological, and social characteristics of older people in Western European and American societies.

SY 630—Individual Work. 1 to 5 credits
Designed to permit graduate students to do work in subjects not available in currently offered courses.

SY 634—Seminar in Family Theories. 4 credits
Developing conceptualizations in investigation of family relationships. Problems and prospects of theoretical frameworks for the analysis of the family.

SY 635—Seminar in Family Research. 4 credits
Major empirical approaches to the investigation of family relationships.

SY 643—Social Research Methods. 4 credits
Advanced studies in the literature of methodology. Statistical, sociometric, and experimental methods.

SY 648—Survey Research. 4 credits
Identical with PCL 615. Prerequisite: STA 320.

SY 651—Seminar in Metropolitan Growth and Development. 4 credits
Prerequisite: 12 credits in social sciences. Nature and scope of metropolitan growth. Theories of urban growth and change; characteristics of metropolitan residential areas; contemporary problems in urban planning.

SY 652—Seminar in Urban Ecology. 4 credits
Urban sociology, with emphasis on urban ecology. Major theories in urban ecology in light of recent findings. Techniques utilized in urban ecology.

SY 653—Seminar in Comparative Urbanization. 4 credits
Prerequisite: SY 350 or consent of instructor. Major trends of urbanization in

the world. Causes and consequences. Relation between urbanization and industrialization.

SY 658—SEMINAR: SOCIOLOGY OF RURAL DEVELOPMENT. 4 credits
Processes of development. Change and stability in the rural setting. Changing patterns of social differentiation and stratification and in the structure and functions of other rural social institutions.

SY 664—SEMINAR IN SPANISH AMERICAN SOCIETIES. 4 credits
Peoples and cultures of Spanish American countries.

SY 665—SEMINAR IN BRAZILIAN SOCIETY. 4 credits
Peoples and institutions of Brazilian life today.

SY 672—SEMINAR IN POPULATION. 4 credits
Prerequisite: SY 471. Readings, seminar reports, and supervised research. Research techniques and population trends in the United States.

SY 673—SEMINAR IN LATIN AMERICAN POPULATION. 4 credits
Prerequisites: SY 471, reading knowledge of either Spanish or Portuguese. Readings, seminar reports, and supervised research in Latin American demography. The interrelationship between demographic and other social phenomena.

SY 674—SEMINAR IN FERTILITY, MORTALITY, AND MIGRATION. 4 credits
Prerequisite: SY 572. Determinants of fertility and mortality with emphasis on Latin American data. Trends, rates, and consequences of migration. The demographic transition in Europe. Impact of family planning programs.

SY 680—SEMINAR IN SOCIAL INTERACTION AND COLLECTIVE BEHAVIOR. 4 credits
Prerequisite: SY 580. Research literature on social interaction, interaction models, roles, and self-conceptions. Analysis of collective phenomena such as crowd behavior, disasters, and mass behavior. May be repeated with change of content up to a maximum of 8 credits.

SY 685—DEVIANCE. 4 credits
Process of stigmatization. Functions of and reactions to deviance. Specific forms including alcoholism, drug abuse, homosexuality, abortion, prostitution.

SY 691—SEMINAR IN AMERICAN MINORITY GROUPS. 4 credits
Prerequisite: SY 391. Readings, reports, and supervised research in American minority groups.

SY 695—SEMINAR IN CONTEMPORARY AFRICAN SOCIETIES. 4 credits
Contemporary peoples and societies of Africa, with emphasis on sub-Saharan Africa and on the social and cultural changes accompanying the end of colonialism.

SY 697—SUPERVISED RESEARCH. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

SY 698—SUPERVISED TEACHING. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

SY 699—MASTER'S RESEARCH. 1 to 17 credits

SY 749—SEMINAR IN METHODS OF SOCIAL RESEARCH. 4 credits
Prerequisites: SY 540, SY 542, SY 643. Reading and research on selected topics. May be repeated with change of content up to a maximum of 12 credits.

SY 798—SPECIAL STUDY IN SOCIOLOGY. 4 credits
Seminar on specialized sociological topics. May be repeated with change of content up to a maximum of 12 credits.

SY 799—DOCTORAL RESEARCH. 1 to 17 credits

SOILS

GRADUATE FACULTY 1970-71

ENO, C. F.; *Chairman;* BLUE, W. G.; BRELAND, H. L.; CALDWELL, R. E.; CARLISLE, V. W.; FISKELL, J. G. A.; GAMMON, N., JR.; HAMMOND, L. C.; HORTENSTINE, C. C.; HUBBELL, D. H.; MANSELL, R. S.; POPENOE, H. L.; PRITCHETT, W. L.; ROBERTSON, W. K.; ROTHWELL, D. F.; SPINKS, D. O.; THORNTON, G. D.; VOLK, G. M.; YUAN, T. L.; ZELAZNY, L. W.

Graduate Coordinator: D. F. ROTHWELL

The fields of graduate work offered in soils are soil chemistry, soil fertility, soil genesis and classification, soil microbiology, and soil physics. The interests of the student and the facilities available determine the field for the thesis problem. The student will present his dissertation in his major field; however, all Doctor of Philosophy candidates will be expected to qualify in the five major fields named above.

Prerequisites: A student who expects to do graduate work in the Department of Soils should present the bachelor's degree from a recognized college of agriculture with a major in soils or the equivalent in other sciences. His background should include at least one course in each of the following: general soils, soil fertility, soil genesis and classification, general bacteriology, general botany, plant physiology, general field crops, general inorganic chemistry, qualitative analysis, and organic or biochemistry. Those not meeting the above requirements will be required to make up any deficiency early in their graduate work. The student will be held responsible for such basic undergraduate courses as are deemed necessary for the pursuit of his special program.

COURSE FOR ADVANCED UNDERGRADUATES AND GRADUATES

SLS 525—TROPICAL SOILS. 3 credits

GRADUATE COURSES

SLS 600—TOPICS IN SOILS. 3 credits
Prerequisite: SLS 330. Variable content; offered by arrangement to qualified students at continuing education centers. May be repeated with change of content up to a maximum of 6 credits.

SLS 621—SOIL CHEMISTRY. 5 credits
Prerequisites: SLS 421, CY 331, CY 341. Clay minerals and their ionic environment. Factors affecting availability and losses of plant nutrient elements.

SLS 622—SOIL MICROBIOLOGY. 4 credits
Prerequisite: SLS 422. Microorganisms of mineral and organic soils; their ecological relationships and metabolic processes.

SLS 623—SOIL GENESIS AND CLASSIFICATION. 3 credits
Prerequisite: SLS 423. Developmental factors, morphological characteristics, systems of classification, and distribution of soils of the world.

SLS 624—SOIL PHYSICS. 4 credits
Prerequisites: SLS 424, PS 211, PS 212, PS 213. The mechanical, thermal, elec-

trical, and optical properties of soils; water-clay mineral interactions. Soil structure and the retention and transmission of water and gases.

SLS 626—Soil Fertility. 4 credits
Prerequisite: SLS 421. Plant response to variations in soil environment.

SLS 627—Laboratory Methods of Soil Chemical Analyses. 4 credits
Prerequisites: SLS 421, CY 331. Instrumental and analytical procedures.

SLS 630—Forest Soils. 4 credits
Identical with FY 630. Prerequisites: SLS 421, SLS 423, FY 403. A study of soils as a component of forest ecosystems. Soil chemical, physical, and biological properties influencing tree growth and biogeochemical cycles.

SLS 651—Seminar. 0 to 1 credit
Presentation of literature, methods of proposed thesis research, and selected topics. May be repeated with change of content up to a maximum of 4 credits.

SLS 670—Non-Thesis Research. 0 to 6 credits
Prerequisite: 15 credits of soils. Study and research in a particular aspect of soils. May be repeated with change of content up to a maximum of 9 credits.

SLS 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

SLS 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

SLS 699—Master's Research. 1 to 17 credits

SLS 799—Doctoral Research. 1 to 17 credits

SPECIAL EDUCATION

GRADUATE FACULTY 1970-71

Reid, W. R., *Chairman;* Boudin, H.; Bullock, L. M.; Cunningham, M. A.; Forgnone, C.; Reichard, C. L.; Richard, W. C.; Whorton, J. E.; Wolking, W. D.

Graduate Coordinator: W. R. Reid

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

EDH 501—Teaching the Mentally Retarded. 4 credits

EDH 503—Teaching Neurologically Damaged Children. 4 credits

GRADUATE COURSES

EDH 600—Teaching Exceptional Children. 4 credits
Prerequisite: EDH 300 or PSY 312. Care, treatment, and education of children with problems and handicaps.

EDH 601—Education of the Mentally Retarded. 4 credits
Prerequisites: EDH 500 or EDH 501; EDH 503. School programs for the retarded. Educational provisions for the retarded who are affected by environmental deprivation and sensory and other impairment.

EDH 603—Education of the Gifted Child. 4 credits
Definitions of giftedness, characteristics of gifted children, and outside-of-school influences which affect the achievement of gifted children.

EDH 604—Precision Teaching of Exceptional Children. 5 credits
Prerequisite: EDH 600. Behavior analysis applied to special education. Procedures for the development of valued behavior in children in need of individualized instruction who are problems in conventional teacher-learner systems.

EDH 605—Advanced Precision Teaching. 4 credits
Prerequisite: EDH 604. Principles of operant conditioning applied to human behavior deficits. Learning disorders as problems in the development of stimulus control.

EDH 607—Laboratory: Evaluation in Special Education. 3 to 6 credits
Prerequisites: EDF 450 or PSY 503; PSY 504. Open only to majors in special education. Tests and other instruments used in evaluating pupils with learning disabilities. May be repeated with change of content up to a maximum of 6 credits.

EDH 620—Educational Theories and Practices for Children with Behavioral Problems. 5 credits
Prerequisites: EDH 520, EDH 600. Corequisite: EDH 621. Current practices and operational rationales; administrative arrangements for present programs and evaluation of the teaching process.

EDH 621—Educational Programming for Children with Behavioral Problems. 5 credits
Prerequisites: EDH 520, EDH 600. Corequisite: EDH 620. Structuring individualized remediation programs for children with behavioral disorders based upon psychoeducational evaluations. Curriculum materials and techniques to increase the cognitive and affective dimensions of personal development.

EDH 622—Resource Utilization for Children with Behavioral Problems. 4 credits
Prerequisites: EDH 520, EDH 600. Community resources for teachers of children with severe behavioral problems. Functions and operations of service agencies and the teacher's role as a facilitation of communication about children.

EDH 630—Individual Work. 2 to 5 credits
Prerequisites: Consent of staff member and department chairman. Only for graduate students who have completed a minimum of 9 hours of graduate work. Before registering, a student must have approval of the proposed project. May be repeated with change of content up to a maximum of 15 credits.

EDH 670—Practicum in Special Education: Mental Retardation. 4 to 12 credits
Prerequisites: EDH 500, EDH 501, EDH 601, and written request six weeks prior to registration for permission to enroll. Tutoring mentally retarded children in educational situations appropriate to the student's professional goals. May be repeated with change of content up to a maximum of 12 credits.

EDH 671—Practicum in Special Education: Emotional Disturbance. 4 to 12 credits
Prerequisites: EDH 520 and written request six weeks prior to registration for permission to enroll. Tutoring emotionally disturbed children. May be repeated with change of content up to a maximum of 12 credits.

EDH 672—Practicum in Special Education: Multiple Handicaps. 4 to 12 credits
Prerequisites: EDH 503, EDH 604 (or corequisite), and written request six weeks prior to registration. Observation and individual diagnosis; individual remediation; group instruction of children with multiple handicaps. May be repeated with change in content up to a maximum of 12 credits.

EDH 690—SPECIAL TOPICS. 2 to 5 credits
Prerequisite: Permission of department chairman. May be repeated with change of content up to a maximum of 15 credits.

EDH 697—SUPERVISED RESEARCH. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EDH 698—SUPERVISED TEACHING. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

EDH 700—SEMINAR IN SPECIAL EDUCATION. 4 credits
Admission limited to special education majors in the Advanced School. Consideration of current problems. May be repeated with change of content up to a maximum of 16 credits.

EDH 701—SEMINAR: MENTAL RETARDATION. 4 credits
Prerequisite: EDH 601. Theoretical implications of mental retardation for intelligence, environment, and behavior.

EDH 702—SEMINAR: CURRENT RESEARCH IN SPECIAL EDUCATION. 4 credits
Problems, design, trends, issues, and implications of current research in special education.

EDH 704—INTERNSHIP: SPECIAL EDUCATION. 3 to 16 credits

EDH 707—SEMINAR IN INSTRUCTIONAL TECHNOLOGY FOR HANDICAPPED LEARNERS. 2 to 4 credits
Prerequisite: EDH 604 and consent of instructor. Recent developments in programmed instruction, teaching machines, multiple channel instructional systems, and computer assisted instruction with particular reference to the education of multiply handicapped learners.

EDH 720—SEMINAR: PROGRAM DEVELOPMENT FOR CHILDREN WITH BEHAVIORAL DISORDERS. 4 credits
Prerequisite: Consent of instructor. Latest innovations in special educational media, models of information dissemination and their implications.

EDH 721—SEMINAR: EDUCATION OF THE EMOTIONALLY DISTURBED CHILD. 4 credits
Prerequisites: Major in special education, admission to the Advanced School, consent of the instructor. Special issues in the education of the emotionally disturbed child. May be repeated with change of content up to a maximum of 16 credits.

SPEECH

GRADUATE FACULTY 1970-71

MOORE, G. P., *Chairman*; ABBOTT, T. B.; BRANDT, J. F.; BZOCH, K. R.; CLARK, A. J.; DEW, D.; GILLETTE, J. M.; GREEN, R. L.; HALE, L. L.; HAMMER, L. C.; HOLLIEN, H. F.; HUTCHINSON, E. C.; JENSEN, P. J.; KARNS, C. F.; KURTZROCK, G. H.; MARKEL, N. N.; MASE, D. J.; PAIGE, A.; POLLOCK, K. C.; SCHOLES, R. J.; TEAS, D. C.; TEW, R. E.; WILLIAMS, D. E.; ZIMMERMAN, L. L.

Graduate Coordinator: L. L. ZIMMERMAN

Graduate programs in speech lead to Master of Arts, Master of Arts in

Teaching, and Doctor of Philosophy degrees, with major emphasis in audiology, communication sciences, general speech, rhetoric and public address, speech pathology, or theatre and interpretation. The Master of Education degree, sponsored jointly by the departments of Speech and Special Education, is also available.

An appropriate undergraduate background in the area of major interest is prerequisite to admission for graduate study. Persons with insufficient undergraduate course preparation will be required to make up deficits.

A student designating speech as a minor, at either the master's or doctoral level, must not register for more than four credits of course work offered by the department without having his projected minor course program approved by the speech representative on his supervisory committee. Graduate students majoring in speech are expected to plan their course programs during their first full term of study, in consultation with their supervisory committee.

Assistantships, fellowships, non-Florida fee scholarships, and traineeships are available.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

SCH 500—Special Topics. 3 to 5 credits
SCH 501—History of Rhetorical Theory. 5 credits
SCH 505—Forms of Public Address. 4 credits
SCH 510—Great Debates in American Life, 1650 to 1860. 4 credits
SCH 511—Great Debates in American Life, 1860 to 1920. 4 credits
SCH 512—Great Debates in American Life, 1920 to present. 4 credits
SCH 520—History of the Theatre 1. 4 credits
SCH 521—History of the Theatre 2. 4 credits
SCH 522—History of the Theatre 3. 4 credits
SCH 526—Problems in Scene Design. 4 credits
SCH 527—Production Costume Design. 4 credits
SCH 540—Principles of Speech Pathology: Articulation Disorders. 4 credits
SCH 541—Principles of Speech Pathology: Voice Disorders. 4 credits
SCH 542—Principles of Speech Pathology: Language Disorders. 4 credits
SCH 543—Principles of Speech Pathology: Stuttering. 4 credits
SCH 549—Principles of Speech Pathology and Audiology: Diagnosis and Appraisal. 4 credits
SCH 560—Principles of Audiological Evaluation 1. 4 credits
SCH 561—Principles of Audiological Evaluation 2. 4 credits
SCH 570—Auditory Training. 4 credits
SCH 571—Visual Communication for the Deaf and Hard of Hearing. 4 credits
SCH 572—Speech and Language for the Deaf and Hard of Hearing. 4 credits
SCH 580—Electro-Acoustical Laboratory. 3 credits
SCH 581—Application of Digital Computers to Speech Research. 3 credits
SCH 585—Advanced Phonetics and Phonemics. 5 credits

SCH 590—NEUROPHYSIOLOGY OF HEARING. 5 credits
SCH 591—AUDITORY PERCEPTION OF SPEECH. 4 credits
SCH 596—LANGUAGE ACQUISITION. 5 credits

GRADUATE COURSES

SCH 600—INTRODUCTION TO GRADUATE STUDY. 4 credits
Required of all graduate students majoring in speech who do not take SCH 680, SCH 681, and SCH 682. Areas of speech, with a review of the literature.

SCH 601—SEMINAR IN ANCIENT AND MEDIEVAL RHETORIC. 5 credits
Selected works of outstanding classical writers who have influenced rhetorical thought, criticism, speaking, and writing.

SCH 602—SEMINAR IN RENAISSANCE AND MODERN RHETORIC. 5 credits
Rhetorical theory of Continental, English, and American writings, 1200 to 1900.

SCH 603—SEMINAR IN CONTEMPORARY RHETORIC. 5 credits
Major trends in contemporary rhetorical thought. Their sources and pedagogical implications.

SCH 605—RHETORICAL CRITICISM. 5 credits
Principles and methods of rhetorical criticism; problems in applying critical standards in the evaluation of public address.

SCH 608—SEMINAR IN AMERICAN PUBLIC ADDRESS. 5 credits
Selected speeches, speakers, and speaking movements which have had an impact on our history.

SCH 609—SEMINAR IN BRITISH PUBLIC ADDRESS. 5 credits
Selected speakers prominent in British history.

SCH 610—SEMINAR IN SOUTHERN PUBLIC ADDRESS. 5 credits
Analysis and evaluation of selected Southern speakers in terms of the speakers, speeches, audiences, and times.

SCH 617—QUANTITATIVE RESEARCH IN RHETORIC AND PUBLIC ADDRESS: APPLIED METHODOLOGIES. 5 credits
Prerequisites: STA 520; PSY 604 or PSY 605. Analysis and design of quantitative studies with emphasis on identifying and predicting behavioral antecedents of orally transmitted messages.

SCH 620—ADVANCED PROBLEMS OF STAGE DIRECTION. 5 credits
Application of production theories to the problems of play direction, and a supervised problem in advanced directing techniques.

SCH 621—ADVANCED PROBLEMS IN SCENE DESIGN. 5 credits
Application of production theories to the problems of scene design, and a supervised problem in advanced scene design.

SCH 622—AMERICAN PLAYS, PLAYERS, AND PLAYWRIGHTS 1. 4 credits
Plays and their production from the Colonial Period to 1860; techniques of outstanding actors and playwrights.

SCH 623—AMERICAN PLAYS, PLAYERS, AND PLAYWRIGHTS 2. 4 credits
American plays and players from 1860 to present.

SCH 624—READINGS IN THEATRICAL HISTORY 1. 4 credits
Selected primary source materials in the history of the theatre to 1660, and their use by theorists and historians.

SCH 625—READINGS IN THEATRICAL HISTORY 2. 4 credits
Selected primary source materials in the history of the theatre from 1660 to the present, and their use by theorists and historians.

SCH 626—Backgrounds in Modern Theatrical Practice. 4 credits
Prerequisite: SCH 522. Plays and production techniques of the modern continental theatre.

SCH 627—Art History of the Theatre. 4 credits
Seminar in changing physical and visual conventions in the theatre, their origins in the visual traditions of the culture, and their effect on the modes of dramatic presentation. May be repeated with change of content up to a maximum of 8 credits.

SCH 628—Seminar in Theatre Aesthetics 1. 4 credits
Growth of the theatre as an art in periods through the Renaissance; the theatre's relation to the aesthetic values of the cultures involved.

SCH 629—Seminar in Theatre Aesthetics 2. 4 credits
Development and modification of aesthetic theory from the Renaissance to the present.

SCH 630—Individual Study. 1 to 10 credits
Available by permission of major professor and department chairman. Project or research course in areas of speech needed by graduate students. May be repeated with change of content up to a maximum of 10 credits.

SCH 631—Styles in Theatrical Art 1. 4 credits
Prerequisites: SCH 520, SCH 521, SCH 522. Styles of dramatic art through the Middle Ages.

SCH 632—Styles in Theatrical Art 2. 4 credits
Prerequisites: SCH 520, SCH 521, SCH 522. Styles of dramatic art from the Middle Ages through 1850.

SCH 633—Styles in Theatrical Art 3.
Prerequisites: SCH 520, SCH 521, SCH 522. Styles of dramatic art from 1850 to the present.

SCH 634—Seminar and Practicum in Modern Theatre Design and Practice. 4 credits
Design, lighting, and costume. May be repeated with change of content up to a maximum of 12 credits.

SCH 638—Speech Research (Theatre). 4 credits
Prerequisite: Permission of the department chairman. Lecture and project course in the more complex problems in speech (theatre).

SCH 639—Theories of Interpretative Reading. 4 credits
Psychological and philosophical theories of creative, artistic oral reading; the teaching of interpretative reading; practice in reading from the works of selected modern authors.

SCH 640—Seminar in Speech Pathology: Articulation Disorders. 4 credits
Prerequisite: SCH 540. Theory and research in articulation disorders.

SCH 641—Seminar in Speech Pathology: Voice Disorders. 4 credits
Prerequisite: SCH 541. Theory and research in voice disorders.

SCH 642—Seminar in Speech Pathology: Language Disorders. 4 credits
Prerequisite: SCH 542. Theory and research in language disorders.

SCH 643—Seminar in Speech Pathology: Stuttering. 4 credits
Prerequisite: SCH 543. Theoretical and experimental literature concerning stuttering and related problems.

SCH 649—CLINICAL PRACTICE IN SPEECH PATHOLOGY: DIAGNOSIS. 1 to 10 credits
Prerequisite: SCH 549. May be repeated with change of content up to a maximum of 10 credits.

SCH 653—ORGANIZATION AND ADMINISTRATION OF SPEECH PATHOLOGY AND AUDIOLOGY PROGRAMS. 4 credits
Administrative problems and practices in varied speech pathology and audiology settings, community clinics, hospitals, schools, universities, training centers, and private practice.

SCH 654—SEMINAR IN SPEECH PATHOLOGY AND AUDIOLOGY: MENTAL RETARDATION. 4 credits
Theory and research in communication problems associated with mental retardation.

SCH 655—SEMINAR IN SPEECH PATHOLOGY AND AUDIOLOGY: CEREBRAL PALSY. 4 credits
Theory and research in communication problems associated with cerebral palsy.

SCH 656—SEMINAR IN SPEECH PATHOLOGY AND AUDIOLOGY: APHASIA. 4 credits
Theory and research in aphasia.

SCH 657—SEMINAR IN SPEECH PATHOLOGY AND AUDIOLOGY: CLEFT PALATE. 4 credits
Evaluation of the theoretical and experimental literature pertaining to speech habilitation and rehabilitation of persons with cleft palate conditions.

SCH 659—CLINICAL PRACTICE IN SPEECH PATHOLOGY:THERAPY. 1 to 15 credits
Supervised clinical practice in speech therapy. May be repeated with change of content up to a maximum of 15 credits.

SCH 660—SEMINAR IN AUDIOLOGY: DIAGNOSTIC PROCEDURES. 4 credits
Prerequisite: SCH 561. Theory and research in differential audiometry and special diagnostic problems.

SCH 661—SEMINAR IN AUDIOLOGY: HEARING AIDS. 4 credits
Prerequisite: SCH 361 or consent of instructor. Electro-acoustic and psychoacoustic aspects of hearing aid evaluation and consultation.

SCH 662—SEMINAR IN AUDIOLOGY: CHILDREN'S AUDIOMETRY. 4 credits
Prerequisite: SCH 361 or consent of instructor. Study of the principles and literature pertaining to the measurement of hearing of children. Clinical observation and practice.

SCH 669—CLINICAL PRACTICE IN HEARING MEASUREMENT. 1 to 10 credits
Prerequisite: SCH 561. Supervised clinical practice in hearing measurement. May be repeated with change of content up to a maximum of 10 credits.

SCH 670—SEMINAR IN AUDIOLOGY: AURAL REHABILITATION. 4 credits
Evaluation of the theoretical and experimental literature of selected problems.

SCH 671—SEMINAR IN AUDIOLOGY: PROBLEMS OF THE DEAF AND HARD OF HEARING. 4 credits
Evaluation of the theoretical and experimental literature pertaining to language and speech of persons with severe and profound hearing loss.

SCH 679—CLINICAL PRACTICE IN AURAL REHABILITATION. 1 to 10 credits
Supervised clinical practice in aural rehabilitation. May be repeated with change of content up to a maximum of 10 credits.

SCH 680—Pro-Seminar in Communication Sciences 1. 3 credits
Scientific and theoretical basis of the communication sciences. Experimental phonetics, audition, psycholinguistics, experimental linguistics, and communicative factors engineering. Required of all beginning students in any communication sciences area.

SCH 685—Experimental Phonetics 1. 3 credits
Principles involved in acoustical and physiological analyses of voice production and laryngeal function. Major theories, experimental procedures, and research findings.

SCH 686—Experimental Phonetics Lab 1. 3 credits
Prerequisite: SCH 685. Laboratory experience in experimental methods and techniques for the study of voice production and analysis of voice signals. Students required to design and carry out an experiment in this area.

SCH 687—Experimental Phonetics 2. 3 credits
Prerequisite: SCH 580. Principles of scientific analysis of speech production and recognition; major theories, experimental procedures, and research findings.

SCH 688—Experimental Phonetics Lab 2. 3 credits
Prerequisite: SCH 687. Laboratory experience in the major experimental methodologies and techniques in speech articulation, resonation, and function. Each student required to design and carry out a pilot study in this area.

SCH 690—Psychoacoustics. 5 credits
Prerequisite: SCH 490. Lectures and discussions on advanced topics and current research in auditory sensation and perception.

SCH 691—Psychoacoustics Laboratory. 3 credits
Prerequisite: SCH 690. Analysis of stimulus generation equipment. Replication of classical experiments.

SCH 692—Psychophysiology of Hearing. 5 credits
Physiological representation of acoustic events within the auditory system. Anatomical information and analysis of electrophysiological literature.

SCH 694—Experimental Linguistics. 5 credits
Prerequisites: SCH 580, SCH 585, EH 606. Nature and use of experimental method in linguistics. Evaluation of selected research topics.

SCH 695—Psycholinguistics. 5 credits
Research literature. Evaluation of theories, historical factors, geographic distinctions, and research procedures related to language development and usage.

SCH 696—Psycholinguistics Laboratory. 3 credits
Prerequisite: SCH 695. Design and analysis of experiments pertaining to the psychology of language. Areas of current research interest.

SCH 697—Supervised Research. 1 to 5 credits
Credit not applicable toward a degree. May be repeated.

SCH 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward a degree. May be repeated.

SCH 699—Master's Research. 1 to 17 credits

SCH 701—Seminar in the Philosophy of Speech Communication. 5 credits
Prerequisites: SCH 603, SCH 605, or SCH 617. Problems, research, and current literature in the theory, criticism, or quantitative exploration of speech communication. May be repeated with change of content up to a maximum of 10 credits.

SCH 720—Seminar in Production Theory Analysis and Application. 4 credits

Contemporary dramatic theories and production concepts with emphasis on critical method.

SCH 749—Practicum in Speech Pathology in a Medical-Dental Setting. 3 to 10 credits

Prerequisites: SCH 649, SCH 659, consent of department. Supervised training in the clinical management of oral communication problems in a medical-dental setting. May be repeated with a change of content up to a maximum of 12 credits. Each succeeding registration requires increasing levels of competence and responsibility.

SCH 769—Practicum in Audiology in a Medical Setting. 3 to 10 credits

Prerequisites: SCH 669 and consent of department. Supervised training in the clinical management of auditory communication problems in a medical setting. May be repeated with change of content up to a maximum of 12 credits. Each succeeding registration requires increasing levels of competence and responsibility.

SCH 772—Seminar in Audiology: Hearing Conservation and Noise Control. 4 credits

Environmental noise: its characteristics, effects on hearing, control, associated topics.

SCH 780—Seminar in Communication Sciences. 3 credits

Advanced research problems in communication sciences.

SCH 785—Seminar in Experimental Phonetics. 3 credits

Advanced research problems in the production of voice or speech.

SCH 786—Seminar in Speech Recognition. 3 credits

Advanced research problems in the analysis and synthesis of speech. Emphasizes vocoders, machine translation, and computer processing of speech.

SCH 790—Seminar in Audition. 3 credits

Research problems in psychoacoustics, or acoustic physiology; recent advances in theories of hearing.

SCH 795—Seminar in Psycholinguistics. 3 credits

Theoretical and research problems in psycholinguistic processes of communication.

SCH 796—Seminar in Experimental Linguistics. 3 credits

Selected problems in linguistic theory and research, with emphasis on experimental analysis.

SCH 799—Doctoral Research. 1 to 17 credits

STATISTICS

GRADUATE FACULTY 1970-71

Mendenhall, W., *Chairman;* Chanda, K. C.; Cornell, J. A.; Davis, C. E.; Hughes, D. T.; Littell, R. C.; Martin, F. G.; Ott, R. L.; Pop-Stojanovic, Z. R.; Rao, P. V.; Saw, J. G.; Scheaffer, R. L.; Shuster, J. J.; Thornby, J. I.; Yang, M. C. K.

Graduate Coordinator: J. G. Saw

Graduate programs are available leading to the Master of Science, Master of Statistics, and Ph.D. degrees. Both master's programs will usually require

two years of course work including the material covered in STA 607, STA 608, STA 609, STA 610, STA 611, STA 612, STA 619, STA 620, and STA 621.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

STA 505—Design and Analysis of Experiments in Biomedical Research. 3 credits

STA 523—Computer Programs in Statistical Analysis 1. 2 credits

STA 524—Computer Programs in Statistical Analysis 2. 2 credits

GRADUATE COURSES

STA 602—Statistical Methods in Research 1. 3 credits

Basic statistical concepts and techniques for students not majoring in statistics. Probability, random variables, estimation, tests of hypotheses, simple linear correlation and regression.

STA 603—Statistical Methods in Research 2. 3 credits

Prerequisite: STA 602. Multiple regression and correlation. Introduction to the basic experimental designs, randomized blocks. Latin square with applications to problems in the physical, biological, and social sciences.

STA 604—Statistical Methods in Research 3. 3 credits

Prerequisite: STA 603. The factorial experiment, covariance analysis, and nonparametric techniques.

STA 605—Advanced Methods of Statistics. 3 credits

Prerequisite: STA 604. Complex experimental designs, including incomplete blocks, confounding, fractional replication, and response surfaces.

STA 607—Design and Analysis of Experiments 1. 3 credits

Prerequisite: STA 441. Basic concepts in the design of experiments. Linear statistical models. The method of least squares and the analysis of variance for orthogonal experimental designs.

STA 608—Design and Analysis of Experiments 2. 3 credits

Prerequisite: STA 607. Multiple comparison procedures. Transformations to stabilize variances. The analysis of enumerative data. Transformations on the independent variables. Orthogonal systems of coding.

STA 609—Design and Analysis of Experiments 3. 3 credits

Prerequisite: STA 608. Response surface exploration. Evolutionary operations. Fractional factorial experiments and incomplete block designs. Some completely random and mixed models.

STA 610—Introduction to Theoretical Statistics 1. 3 credits

Prerequisite: MS 304. Theory of probability. Probability spaces, continuous and discrete distributions, functions of random variables. Expectations, moment and probability generating functions. Applications.

STA 611—Introduction to Theoretical Statistics 2. 3 credits

Prerequisite: STA 610. Properties of point estimators. Least squares, maximum likelihood, and Bayesian procedures. Confidence intervals, multivariate normal distributions, and introduction to the theoretical basis for analysis of variance.

STA 612—Introduction to Theoretical Statistics 3. 3 credits

Prerequisite: STA 611. Tests of hypotheses, decision theory, nonparametric tests.

STA 615—Statistical Methods in Business Research. 5 credits
Prerequisite: BS 664 or its equivalent. Planning and implementation for an experimental research project. Model formulation, experimental design, methods of inference, regression analysis, analysis of variance and nonparametric methods. Computer techniques.

STA 619—Theory of Least Squares. 4 credits
Prerequisite: STA 611. Application of the Markov theory of least squares to the problems of estimation and tests of hypotheses; distribution theory under normal assumptions.

STA 620—Theory of Completely Random and Mixed Models. 4 credits
Prerequisite: STA 619. General theory and application of completely random and mixed models. Reference to problems in estimation and tests of hypotheses.

STA 621—Design of Experiments. 4 credits
Prerequisite: STA 527. Continuation of STA 527. Applications of confounding and fractional replication, design and analysis of balanced and partially balanced incomplete block designs, further considerations of the mixed model.

STA 622—Sampling Theory and Application. 4 credits
Prerequisite: STA 611. Theory of basic sampling procedures in economic and social surveys. Multistage sampling, cost functions, double sampling, sampling of time series.

STA 623—The Analysis of Multivariate Data. 4 credits
Prerequisite: STA 522 or STA 527. Multivariate normal distribution, discriminant, canonical, principal component, and factor analysis.

STA 624—Sampling Theory and Application 2. 4 credits
Prerequisite: STA 622. Continuation of STA 622. Stochastic processes as applied to sampling theory and other current research topics in sampling.

STA 626—Applied Time Series Analysis. 4 credits
Prerequisite: STA 442 or STA 525. Linear time series models; statistical analysis of linear stationary and nonstationary time series with applications and case studies supplemented by simulation studies.

STA 628—Problems in Statistics. 1 to 5 credits
Prerequisite: Permission of department. Special problems in research methods, sampling methods, and experimental design. May be repeated with change of content up to a maximum of 9 credits.

STA 635—Biostatistics 1. 4 credits
Prerequisite: STA 522 or STA 527. Statistical methods in biological assay; direct assays; indirect assays; dose-response relationships; nonlinear regression; parallel line assays; potency estimation.

STA 636—Biostatistics 2. 4 credits
Prerequisite: STA 635. Inferences from hospital data; nonparametric methods in medical research including distribution free multiple comparisons, rank analysis of covariance, indices of order association; nonparametric partial correlation; multidimensional contingency tables.

STA 637—Biostatistics 3. 4 credits
Prerequisite: STA 636. Multivariate problems in biostatistics; repeated measurements; discriminant analysis; diagnostic models; factor analysis; current topics in biostatistics.

STA 640—Probability Theory 1. 4 credits
Prerequisites: STA 610, advanced calculus. Measure theoretic approach to probability: random variables, probability functions, distribution functions, expectation, characteristic functions.

STA 641—Probability Theory 2. 4 credits
Prerequisite: STA 640. Notions of convergence of sequences of independent random variables: continuity theorem, law of large numbers, central limit theorem.

STA 642—Probability Theory 3. 4 credits
Prerequisite: STA 641. Continuation of STA 641. Exact and asymptotic theories of sampling distributions.

STA 650—Nonparametric Statistics 1. 4 credits
Prerequisite: STA 612. Distribution theory for order statistics. Estimators and tests for percentiles. Distribution of range, studentized range and related problems. Tests for outliers. Substitute t and F tests. Applications of order statistics in life-testing problems. Theory of linear estimation using order statistics.

STA 651—Nonparametric Statistics 2. 4 credits
Prerequisite: STA 650. Theory and methodology of distribution-free statistics not covered in STA 650.

STA 652—Sequential Analysis. 4 credits
Prerequisite: STA 612. Sequential likelihood ratio tests of two competing simple hypotheses. Operating characteristics, average sample number, and optimal properties.

STA 660—Stochastic Processes 1. 3 credits
Prerequisite: STA 610. Discrete time and state models. Gambler's Ruin. Persistent and transient states: long run and stationary distribution mean absorption times, mean first passage times.

STA 661—Stochastic Processes 2. 3 credits
Prerequisite: STA 660. Continuous time, discrete state models. Poisson, generalized Poisson, and filtered Poisson processes. Polya process. Birth and death models. Application to the theory of queues and inventories.

STA 662—Stochastic Processes 3. 3 credits
Prerequisite: STA 661. Wiener-Levy process; Ornstein Uhlenbeck process. Integrated processes. White noise and thermal noise. Applications of stochastic processes in the physical sciences.

STA 670—Multivariate Analysis 1. 4 credits
Prerequisite: STA 619. Multivariate tests of hypotheses. Construction of multivariate confidence regions, multivariate analysis of variance, discriminant analysis and tests of independence.

STA 671—Multivariate Analysis 2. 4 credits
Prerequisite: STA 670. Continuation of STA 670.

STA 680—Time Series 1. 4 credits
Prerequisites: STA 642, MS 643. Statistical theory of stationary time series; estimation and tests of hypotheses concerning the spectral density.

STA 681—Time Series 2. 4 credits
Prerequisite: STA 680. Statistical analysis of parametric models; distribution of spectral estimates.

STA 682—Time Series 3. 4 credits
Prerequisite: STA 681. Problems in linear estimation. Applications and recent developments discussed in journal articles.

STA 683—Advanced Probability Theory 1. 4 credits
Prerequisite: MS 643. Probability at the level of Loeve's "Probability Theory." Probability, independence, and dependence.

STA 684—Advanced Probability Theory 2. 4 credits
Prerequisite: STA 683. Continuation of STA 683.

STA 690—Special Topics in Statistics. 4 credits
Prerequisite: Permission of the graduate advisor. Assigned reading of lecture series in advanced statistics. May be repeated with change of content up to a maximum of 18 credits.

STA 691—Seminar. 1 credit
Prerequisite: Permission of department. Special topics of an advanced nature suitable for seminar treatment but not given in regular courses. May be repeated.

STA 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

STA 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

STA 699—Master's Research. 1 to 17 credits

STA 740—Advanced Statistical Inference 1. 4 credits
Prerequisites: STA 612, STA 642. Theory of decision functions: estimation and testing statistical hypotheses.

STA 741—Advanced Statistical Inference 2. 4 credits
Prerequisite: STA 740. Continuation of STA 740.

STA 799—Doctoral Research. 1 to 17 credits

VEGETABLE CROPS

GRADUATE FACULTY 1970-71

Marlowe, G. A., Jr., *Chairman*; Gull, D. D.; Hall, C. B.; Halsey, L. H.; Locascio, S. J.; Lorz, A. P.; Nettles, V. F.; Thompson, B. D.

Graduate Coordinator: B. D. Thompson

Prerequisites: 30 credits of satisfactory work in horticultural science of which 18 must have been in, or closely allied with, vegetable crops. Additionally, the student should have satisfactorily completed basic science courses including botany, entomology, plant pathology, and soils. If deficiencies exist, students must satisfy these requirements early in the graduate program.

The following courses in related areas will be acceptable for graduate credit as part of the candidate's major. OH 612—Nutrition of Ornamental Plants; FC 615—Agricultural Meteorology; FC 602—Physiology of Fruit Crops; BTY 617—Plant Metabolism; AY 662—Advanced Genetics; AY 660—Cytogenetics.

GRADUATE COURSES

VC 603—Vegetable Crops Seminar. 1 to 2 credits
May be repeated with change of content up to a maximum of 2 credits.

VC 607—Topics in Vegetable Production Principles. 3 or 4 credits
Offered primarily to Agricultural Extension and vocational agriculture teachers. When offered this course will be announced with one of the following topics specified: production principles, principles and practices in handling and marketing, nutrition of vegetables, role of agricultural chemicals. May be repeated with change of content up to a maximum of 10 credits.

VC 615—Advanced Vegetable Technology. 5 credits
Prerequisite: BTY 310. Survey of scientific knowledge related to the production of vegetable crops.

VC 621—Techniques and Methods of Vegetable Breeding. 4 credits
Prerequisite: AY 362. Desirable prerequisites: PLS 452, BTY 551. Techniques in the breeding of vegetables for horticultural qualities and for resistance to diseases and animal pests, and of methods of testing new vegetable introduction.

VC 651—Postharvest Vegetable Physiology. 5 credits
Prerequisites: VC 451, BTY 310, or consent of instructor. Advances in plant physiology and other areas of science applied in quality maintenance and postharvest handling of vegetable crops.

VC 660—Practicum in Vegetable Crops. 4 to 8 credits
Admission limited to graduate students majoring in Vegetable Crops. Supervised and individual work in the field of professional instruction and research procedures. May be repeated with change of content up to a maximum of 12 credits.

VC 670—Non-Thesis Research in Vegetable Crops. 2 to 5 credits
Library, laboratory, and field studies in production, breeding, and handling of vegetable crops. May be repeated with change of content up to a maximum of 10 credits.

VC 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

VC 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

VC 699—Master's Research. 1 to 17 credits

VC 799—Doctoral Research. 1 to 17 credits

VETERINARY SCIENCE

GRADUATE FACULTY 1970-71

Edds, G. T., *Chairman;* Bradley, R. E.; Cardeilhac, P. T.; Forrester, D. J.; Himes, J. A.; Neal, F. C.; Neilson, J. T.; Simpson, C. F.; Taylor, W. M.; White, F. H.

Graduate Coordinator: G. T. Edds

Excellent opportunities are available for qualified students to obtain research training and experience in animal and poultry diseases. The candidate should have a good background in zoology, genetics, chemistry, biochemistry, physics, bacteriology, anatomy, and physiology. Deficiencies in the prerequisites must be satisfied as soon as possible.

At least 27 credits of course work are to be selected from the major, including veterinary research techniques, veterinary parasitology, pathology, hematology, microbiology, pharmacology, toxicology, and laboratory animal diseases; a related minor subject is to be chosen in consultation with the major adviser.

Programs leading to the degree Doctor of Philosophy, with emphasis on problems related to animal or poultry diseases, may be obtained through

the Department of Animal Science with the cooperation of the faculty of Veterinary Science.

Students may receive financial aid through assistantships, fellowships, and research associateships.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

VY 506—Laboratory Animal Medicine. 5 credits
VY 516—Animal Parasitology. 5 credits
VY 522—Veterinary Physiology 1. 5 credits
VY 523—Veterinary Physiology 2. 5 credits
VY 562—Veterinary Parasitology 1. 5 credits
VY 563—Veterinary Parasitology 2. 5 credits

GRADUATE COURSES

VY 602—Veterinary Pathology 1. 5 credits
Prerequisites: Degree in one of the medical sciences; suitable background in histology and approval of major professor. Topics in pathologic conditions affecting animals, with emphasis on cellular changes.

VY 603—Veterinary Pathology 2. 5 credits
Prerequisite: VY 602. Continuation of VY 602.

VY 622—Veterinary Hematology 1. 5 credits
Prerequisite: Suitable background in biology, physical chemistry, biological chemistry, histology, physiology, and immunology. Topics on hematologic problems of domestic and laboratory animals, including poultry.

VY 623—Veterinary Hematology 2. 5 credits
Prerequisite: VY 622. Continuation of VY 622.

VY 624—Helminthology. 5 credits
Identical with ZY 624. Prerequisite: ZY 516.

VY 625—Protozoology. 5 credits
Identical with ZY 625.

VY 632—Veterinary Pharmacology 1. 5 credits
Prerequisites: Suitable background in the medical sciences; satisfactory work in physiology, biochemistry, and immunology. Selected problems in prevention, treatment, and control of animal diseases.

VY 633—Veterinary Pharmacology 2. 5 credits
Prerequisite: VY 632. Continuation of VY 632.

VY 634—Veterinary Toxicology 1. 5 credits
Prerequisites: VY 633 and suitable background in biochemistry, physiology, and pharmacology. Effects of toxic natural products and chemicals on animals.

VY 635—Veterinary Toxicology 2. 5 credits
Prerequisite: VY 634. Continuation of VY 634.

VY 642—Veterinary Microbiology 1. 6 credits
Prerequisite: Suitable background in the medical sciences. Special emphasis in the bacteriology and/or virology of diseases limited to animals and the zoonoses.

VY 643—Veterinary Microbiology 2. 6 credits
Prerequisite: VY 642. Continuation of VY 642.

VY 663—Parasitic Diseases in the Tropics and Subtropics. 5 credits
Identical with MCY 663, MED 663, ZY 663. See MCY 663.

VY 682—Veterinary Research Techniques 1. 5 credits
The principles of biophysical science and their application to veterinary medical science.

VY 683—Problems in Veterinary Science 2. 1 to 5 credits
Prerequisite: VY 682. Continuation of VY 682. May be repeated with change of content up to a maximum of 5 credits.

VY 690—Seminar in Veterinary Science. 1 credit
May be repeated with change of content up to a maximum of 6 credits.

VY 697—Supervised Research. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

VY 698—Supervised Teaching. 1 to 5 credits
Credit not applicable toward degree. May be repeated.

VY 699—Master's Research. 1 to 17 credits

VOCATIONAL, TECHNICAL, AND ADULT EDUCATION

GRADUATE FACULTY 1970-71

Hensel, J. W., *Chairman;* Beeman, C. E.; Carr, G. D.; Crews, J. W.; Grigsby, S. E.; Loften, W. T.; Patterson, S. D.

Graduate Coordinator: J. W. Hensel

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

EDV 540—Principles of Business Education. 4 credits

EDV 560—Technical Education Program Development. 4 credits

EDV 570—Education for Adults. 4 credits

EDV 571—Methods, Materials, and Evaluation in Adult Education. 4 credits

EDV 580—Curriculum in Vocational-Technical Health-Occupation Education. 4 credits

GRADUATE COURSES

EDV 600—The Administration of Vocational Education. 4 credits
Basic principles of administering a program of vocational education on national, state, and local levels.

EDV 601—Foundations of Program Planning for Vocational Education. 4 credits
Socio-economic forces; school-community relationships; employee-employer relationships; principles, concepts, and practices affecting policy and program planning in vocational education.

EDV 602—The Supervision of Vocational Education. 4 credits
Concepts and supervisory procedures pertaining to the supervision of different facets of local, state, and national programs of vocational education.

EDV 620—History and Philosophy of Agricultural Education. 4 credits
Historical developments of agricultural education from its beginning in other

countries to the present program in the United States with attention to changing philosophies.

EDV 621—Developing Community Programs in Agriculture. 3 credits
Application of basic principles and practices in developing community programs in agriculture at high school and post-high school levels.

EDV 622—Developing Curricular Materials for Programs in Agriculture. 3 credits
Development of appropriate curricular materials for high school and post-high school programs in agriculture; preparation of materials by class members.

EDV 623—Problems in Agricultural Education. 2 to 9 credits
For students qualified to select and pursue advanced research problems. May be repeated with change of content up to a maximum of 9 credits.

EDV 624—Supervised Occupational Experiences in Agricultural Education. 4 credits
Basic problems in planning and supervising programs of occupational experiences in view of changes occurring in agricultural occupations.

EDV 625—Adult Education in Agriculture. 5 credits
The establishment, organization of classes, use of appropriate teaching procedures, and evaluation of programs of adult education in agriculture.

EDV 630—Individual Work in Vocational, Technical, and Adult Education. 2 to 5 credits
For advanced students wishing to study under faculty guidance. Problems in vocational, technical, or adult education. Before registering, a student must have approval of the proposed study. May be repeated with change of content up to a maximum of 15 credits.

EDV 640—Teaching Office Machines. 4 credits
Prerequisite: EDV 346. Functions of machines, their suitabilities for various office functions, methods of teaching operation of machines commonly used in offices.

EDV 641—Teaching Secretarial Studies. 4 credits
For teachers of business subjects. Curriculum, materials, and methods of teaching secretarial subjects.

EDV 642—Teaching Bookkeeping and Consumer Business Subjects. 4 credits
Curriculum, materials, and methods of teaching bookkeeping, economics of business, business law, salesmanship, and business arithmetic.

EDV 643—Materials and Methods of Teaching General Business. 4 credits
Objectives, content, resource materials, and methods of teaching general business in the junior and senior high schools.

EDV 644—Problems in Business Education. 4 credits
Areas of interest to students enrolled are studied. Problems in business education in Florida schools emphasized.

EDV 645—Seminar and Work Experience in Business Education. 8 credits
Prerequisite: Permission of department. Evaluation of effectiveness of the secondary school business education program in meeting needs of students for beginning office employment.

EDV 646—Methods and Materials for Block-Time Instruction in Office Education. 4 credits

Development of instructional plans where large blocks of time are used. Emphasis on developing concept of integrated or whole-office model and instructional materials for use in classrooms.

EDV 647—Research Seminar in Business Education. 4 credits

Prerequisite: EDF 360. Nature and purpose of research in business education. Guides for conducting research. Dissemination of research findings.

EDV 660—Technical Education in Post-High School Programs. 4 credits

Analysis of technical education in modern society, with emphasis on college and other post-high school programs leading to Associate of Science or similar degrees or certificates of competency in technical and semi-professional occupations.

EDV 661—Teaching Technical Education. 4 credits

Prerequisite: Bachelor's degree in a technical area. Objectives, content, resource materials, evaluation, and methods of teaching technical subjects at the post-high school level.

EDV 670—Adult Education: Progress and Prospects. 4 credits

Historical development, objectives, scope, trends, and significance of adult education. Philosophy and trends of adult education in relation to present and future public education programs.

EDV 690—Special Topics. 2 to 5 credits

Prerequisite: Permission of department chairman. May be repeated with change of content up to a maximum of 15 credits.

EDV 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

EDV 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

EDV 770—Adult Education in the Community College (Junior College). 4 credits

Types of community college programs in adult education. Methods of community survey and ways of identifying and defining educational needs of adults.

EDX 601—Advanced Agricultural Leadership. 4 credits

Training in leadership opportunities and responsibilities in agriculture, including small group leadership, program planning, community organization and development, human relationships, public affairs, and public policy. May be repeated with change of content up to a maximum of 12 credits.

EDX 604—Agricultural and Extension Education Through Group Action. 4 credits

Advanced techniques in developing programs of agricultural and extension education through group action. May be repeated with change of content up to a maximum of 12 credits.

EDX 621—Research in Agricultural and Extension Education. 1 to 4 credits

Library and workshop related to methods in agricultural and extension education, including study of research work, review of publications, and development of written reports. May be repeated with change of content up to a maximum of 9 credits.

ZOOLOGY

GRADUATE FACULTY 1970-71

DeWitt, R. M., *Acting Chairman*; Auffenberg, W.; Austin, O. L., Jr.; Berner, L.; Brodkorb, P.; Brookbank, J. W.; Carr, A. F.; Carr, W. E.; Dickinson, J. C., Jr.; Elliott, P. R.; Emmel, T. C.; Giesel, J. T.; Gilbert, C. R.; Goin, C. J.; Gregg, J. H.; Johnson, F. C.; Johnston, D. W.; Jones, E. R.; Kaufmann, J. H.; Kilby, J. D.; Laessle, A. M.; Leavitt, B. B.; Maturo, F. J. S.; McNab, B. K.; Nordlie, F. G.; Patton, T. H.; Reiskind, J.; Wallace, H. K.; Wallbrunn, H. M.; Webb, S. D.; Westfall, M. J.; Zam, S. G.

Graduate Coordinator: R. M. DeWitt

The Department of Zoology offers graduate work leading to the degrees of Master of Science in Teaching, Master of Science, and Doctor of Philosophy. The work of the department is divided into two general areas: comparative biology of the whole organism, and studies at the cellular and molecular level of organization. All candidates for graduate degrees will be required to take the following: introductory biology or zoology, ecology, embryology, comparative anatomy or functional morphology, invertebrate or vertebrate zoology, genetics, cellular physiology, one year of physics, chemistry through organic, and a sequence in mathematics or statistics. The remainder of the student's program will be determined by his supervisory committee.

Undergraduate preparation in zoology: Prospective graduate students should take as undergraduates as many as possible of the courses listed in the preceding paragraph. These courses constitute a *core curriculum* for all candidates for the M.S.T., M.S., and Ph.D. degrees. Any of the courses not taken as an undergraduate must be made up early in the graduate program and without graduate credit.

Entrance requirements: The minimum requirements for admission to the graduate program in zoology include an average of 500 or better on the Verbal and Quantitative portions of the Graduate Record Examination and a major in zoology plus a total of 30 credits in chemistry, physics, and mathematics, or a major in chemistry, physics, or mathematics plus 21 credits in zoology. Students with special training or aptitudes may be allowed some variation in prerequisites.

Examinations: All graduate students will be given a written examination covering the zoological portion of the core program by the Departmental Examining Committee early in their first term of residence. The results of this examination will be used in planning the student's program. It will be the responsibility of the candidate's supervisory committee to take whatever action is necessary to insure that the nonzoological portion of the core program is satisfactorily completed.

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES

ZY 505—General Ecology. 5 credits
ZY 507—Vertebrate Paleontology. 4 credits
ZY 516—Animal Parasitology. 5 credits
ZY 521—Comparative Histology. 5 credits
ZY 529—Behavioral Ecology. 5 credits
ZY 542—History of the Biological Sciences. 3 credits
ZY 545—Physiological Genetics. 4 credits
ZY 551—Cytology. 5 credits
ZY 570—Cellular Physiology. 5 credits
ZY 571—Techniques in Cellular Physiology. 1 credit
ZY 574—Animal Physiology. 5 credits
ZY 579—The Biology of Marine Animals. 4 credits

GRADUATE COURSES

ZY 605—Tropical Biology: An Ecological Approach. 12 credits
Identical with BLY 605, BTY 605. Field study of ecological concepts in tropical environments. Offered summer quarters in Costa Rica as part of the program of the Organization for Tropical Studies.

ZY 607—Ancient Vertebrate Faunas. 4 credits
Identical with GY 607. Prerequisite: ZY 507 or GY 507. Evolution, distribution, and extinction of vertebrate faunas with emphasis on problems in paleoecology, paleogeography, and patterns of phylogeny.

ZY 608—Seminar in Evolution. 4 credits
Identical with GY 608. Processes, mechanisms, patterns, and orientation of evolution.

ZY 609—Zoogeography. 3 credits

ZY 610—Advanced Tropical Zoology. 12 credits
Identical with BLY 610. Vertebrate or invertebrate group selected as basis for studies of ecological systems in the tropics. Effects of elevation and temperatures on populations, successions, microhabitat, distribution, predation, evolution, and other aspects. Offered winter and summer quarters in Costa Rica as part of the program of the Organization for Tropical Studies.

ZY 612—Marine Ecology. 5 credits
Prerequisites: ZY 308, CY 213 or equivalent. Marine communities and the physical and chemical factors that influence them.

ZY 624—Helminthology. 5 credits
Identical with VY 624. Prerequisite: ZY 516. Physiology, biochemistry, life cycles, and morphology of the helminths. The host-parasite relationship and immune responses.

ZY 625—Protozoology. 5 credits
Identical with VY 625.

ZY 626—Community Ecology. 5 credits
Prerequisite: ZY 505. Selected animal habitats, their occupants and organization. Classroom work evaluates community concept and appraises role of ecology in evolution.

ZY 628—Limnology. 5 credits
Prerequisites: ZY 505, BTY 380, CY 213. Biological, chemical, and physical dynamics of inland waters.

ZY 629—SEMINAR IN ECOLOGY. 2 credits
Prerequisites: ZY 505, ZY 626. May be repeated with change of content up to a maximum of 6 credits.

ZY 630—INDIVIDUAL STUDIES IN ZOOLOGY. 4 credits
Studies selected from the following fields: comparative anatomy, cytology, ecology, embryology, fresh water biology, genetics, herpetology, histology, icthyology, invertebrate zoology, including arachnology and insect biology, limnology, malacology, mammalogy, marine biology, ornithology, parasitology, general or comparative physiology, protozoology, vertebrate paleozoology, animal behavior, and zoogeography. May be repeated only with special permission. May not be taken by students on academic probation.

ZY 632—ADVANCED INVERTEBRATE ZOOLOGY. 4 credits
Prerequisite: ZY 308.

ZY 633—PRINCIPLES OF SYSTEMATIC ZOOLOGY. 3 credits
Selected taxonomic synopses, revisions, and monographs; distribution, genetics, and ecology of taxonomic problems.

ZY 642—PHYSIOLOGICAL ECOLOGY. 5 credits
Prerequisites: ZY 570, ZY 571. Physiological mechanisms that influence distribution and ecological relations, water conservation, and energy exchange in vertebrates.

ZY 647—EXPERIMENTAL EMBRYOLOGY. 3 credits
Prerequisites: ZY 310, ZY 570, ZY 571. Problems of embryonic development and the experimental approach to their solution.

ZY 648—EXPERIMENTAL EMBRYOLOGY LABORATORY. 2 credits
Prerequisite or corequisite: ZY 647. Modern techniques for the analysis of embryonic development in a wide variety of zoological material.

ZY 651—ICHTHYOLOGY. 5 credits
Prerequisite: ZY 306.

ZY 652—HERPETOLOGY. 5 credits
Prerequisite: ZY 306.

ZY 653—MAMMALOGY. 5 credits
Prerequisite: ZY 306.

ZY 654—ORNITHOLOGY. 4 credits
Prerequisite: ZY 306.

ZY 664—TOPICS IN GENETICS. 2 to 4 credits
Identical with AL 664, AY 664, BCY 664, BTY 696, PY 664. See AY 664. May be repeated with change of content up to a maximum of 12 credits.

ZY 665—ECOLOGICAL GENETICS. 5 credits
Prerequisites: ZY 325, ZY 505, STA 520. Mutation, migration, selection, density, subdivision, behavior, and maintenance of variability as they affect the genetic structure of natural populations.

ZY 667—THEORETICAL POPULATION ECOLOGY. 5 credits
Prerequisites: ZY 325 or AY 362 and AY 363; ZY 505 or BTY 501; STA 520. Analysis of mechanisms controlling distribution and density of animal populations in terms of quantitative data and models.

ZY 668—FIELD POPULATION ECOLOGY. 5 credits
Prerequisites: ZY 325; ZY 505 or BTY 501. Interaction of population structure, genetic properties and ecological factors in controlling the dynamics and evolutionary character of natural populations.

ZY 671—ETHOLOGY. 4 credits
Prerequisite: ZY 505. History, concepts, and methods of the comparative study

of animal and human behavior. The biological substrate and classification of behavior.

ZY 673—Seminar in Animal Behavior. 3 credits

Prerequisite: ZY 671. Special behavioral topics. May be repeated with change of content up to a maximum of 9 credits.

ZY 690—Special Topics in Zoology. 4 credits

Special topics, studied with small groups of students, include wildlife conservation, fishery biology, cytogenetics, taxonomy, and natural history of arthropods. May be repeated with change of content up to a maximum of 12 credits.

ZY 697—Supervised Research. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

ZY 698—Supervised Teaching. 1 to 5 credits

Credit not applicable toward degree. May be repeated.

ZY 699—Master's Research. 1 to 17 credits

ZY 799—Doctoral Research. 1 to 17 credits

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